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ABSTRACT

This intensive longitudinal study of mother-infant interaction during the first year of life focuses on the development of attachment. Data on 26 middle-class families were collected by five methods: (1) naturalistic observation of each mother-infant pair during 4-hour home visits, which occurred at 3-week intervals from the infants' 3rd to 54th week of life; (2) observation in a controlled laboratory situation (the "strange situation"), beginning when infants were 51 weeks of age; (3) non-directive interviews with the mother and other adults in the household; (4) testing with the Griffiths' Infant Intelligence Scale approximately every nine weeks; and (5) examination of medical records. Observational data were emphasized in the data analysis. The analysis is discussed extensively under four headings: normative records of attachment behaviors, individual differences, hierarchical organization of attachment behavior, and the influence of environmental variation, specifically maternal behavior. (GO)

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THE DEVELOPMENT OF INFANT-MOTHER ATTACHMENT

A FINAL REPORT TO

THE OFFICE OF CHILD DEVELOPMENT

Mary Salter Ainsworth

INTRODUCTION

This study is an intensive, longitudinal study of mother-infant interaction throughout the first year of life. It focuses on the development of infant-mother attachment, but the data collected are generally relevant to early social development, its intertwining with cognitive development, and the relationship between these two major lines of development and environmental conditions, especially maternal behavior.

This is essentially a naturalistic study conducted through observations of the behavior of infant, mother, and other figures in the natural environment of the home. The findings are based on approximately 68 hours of observation for each of 26 infant-mother pairs, in the course of visits occurring at 3-week intervals from the infant's third to fifty-fourth week of age. In order to preserve the continuity of mother-infant interaction, and to discover new relations between maternal behavior and infant development, the raw data of the study consist of narrative reports of behavior observed during the home visits rather than tallies on checklists of behavioral variables drawn up in advance of the study. This methodological approach has proved to be fruitful in its yield, but it has also made the process of data analysis very much more time-consuming than a time-sampled, check-list approach would have done.

To supplement the home observations, two kinds of standardized situations have been used: periodic testing with the Griffiths' scale of infant mental abilities, and one standard laboratory situation--the "strange situation"--to which the infants were introduced at 51 weeks of age. The strange-situation procedure has been found to provide a powerful basis for appraising the quality of the infant-mother attachment relationship. The Griffiths' testing has been useful in our investigation of the relationship between maternal behavior and rate of infant development.

This is a unique study. Its uniqueness lies not so much in its naturalistic, intensive, observational approach spanning the whole of an infant's first year--for there have been a few other studies that have utilized a similar approach--but in the fact that the massive accumulation of descriptive data has been (and will continue to be) subjected to quantitative treatment and to statistical analysis, and that the findings have been (and will continue to be) prepared for publication in a form other than of clinical descriptions and generalizations. It is acknowledged that the data of a few other longitudinal studies of mother-infant interaction, such as those by Mahler and her associates (Mahler, 1963, 1965; Mahler & La Perriere, 1965; Pine & Furer, 1963), Sander (1962, 1964, 1969), and Katherine Wolf, might have been treated similarly--and indeed there are indications that these investigators intended eventually to do so, although vagaries of grant support and, in the instance of Wolf, death, militated against completion of the analysis of the data that had been collected so painstakingly. This study is therefore unique in that it is the only one in which the orientation of the investigator has been persistent enough and the support given by grant-awarding agencies continuous enough that there has already been a substantial yield of findings that meet established standards of scientific excellence, and not merely clinical standards of useful and provocative observation.

I do not believe that I can overestimate the significance of this project, in terms of both its heuristic contribution and its eventual practical implications. Ever since Freud it has been accepted that an infant's early social relations, and particularly his relationship with his mother figure, have a profound influence on his subsequent development. Much clinical evidence has accumulated to support his hypothesis, but neither Freudian theory nor other varieties of psychoanalytic theory have provided conceptual tools that could guide empirical studies with any substantial degree of success. Social learning theory sparked research into problems of "socialization" but by its very nature was little concerned with the study of a specific relationship or bond between any two people, since it is concerned primarily with general learning processes.

It was not until the concept of attachment, with its ethological and evolutionary background, began to have an impact on the developmental sciences that we were equipped with both heuristic concepts and a research strategy appropriate to an incisive investigation of the infant-mother relationship and its development. The recent award of the Nobel prize in medicine to the founders of ethology--Lorenz, Tinbergen, and von Frisch--acknowledged the value that ethological concepts and principles have already had for research into some human issues that have proved recalcitrant to other approaches. Bowlby, much influenced by Lorenz, Tinbergen, and also Hinde, was primarily responsible for formulating the ethological-evolutionary concept of attachment. My work, including the work already accomplished in the present project, has contributed an important part of the empirical foundation from which attachment theory has stemmed.

A great deal of the recent surge of research interest in mother-infant interaction has been inspired by Bowlby and by attachment theory. Attachment theory is cast in terms of a new paradigm that is as yet imperfectly grasped by many of the developmentalists who are trying to work with it, since their thinking tends still to be shaped by earlier paradigms. Consequently the current "attachment" literature is seemingly full of controversy and seeming contradictions in findings and the interpretation thereof. I believe that the completion and further coordinated publication of the findings of the present project will be valuable as a framework in the context of which the findings of a wide variety of other researches may be coordinated and understood. So far the publication of our findings has of necessity been piecemeal. For the true heuristic value of the project to be realized it is necessary to show how all the findings of our component data analyses fit together into an organized whole.

The eventual practical implications of this research are of perhaps even greater importance than its theoretical or heuristic value. From the beginning I believed that the project would throw light both on the origins of certain pathologies and on infant-care practices that might prevent pathological development. The history of injunctions to parents and other caregivers is rife with contradictions, and marked by swings from one extreme to another. The pronouncements of experts on infant rearing have to date had very little basis in research, but rather have rested largely upon extrapolations from theory or from clinically-obtained retrospective reports from older patients or second-hand reports obtained from parents. The present project provides a substantial beginning toward laying a sound research foundation on the basis of which a more valid set of recommendations for infant care may be framed. There is no doubt that current public concern has as a major focus the formulation of policies, procedures, and institutions intended to forward the optimal development of children even despite initial socio-economic or cultural disadvantage. The findings of this present research project have already proved to be relevant to this concern; the completion of the project will greatly increase its practical yield.

THEORETICAL AND EMPIRICAL BACKGROUND OF THE STUDY

The theoretical and empirical background of the study are intertwined. In 1954-55 I went to Uganda, and while there undertook a study of mother-infant interaction among Ganda infant-mother pairs (Ainsworth, 1963, 1964, 1967), which not only served as a pilot study for the present project but which also provides a useful basis for cross-cultural comparison (Ainsworth, in press, [a]). At about the same time John Bowlby, with whom I had worked closely throughout 1950-53 on problems of maternal deprivation and mother-infant separation and their effects, having found psychoanalytic theory inadequate to account for these effects, began to explore ethology and evolutionary theory for a more adequate theoretical understanding of the phenomena associated with the deprivation of opportunity for an infant to form a tie with anyone, the interruption of a bond already formed with a specific mother figure, and indeed the history of the mother-infant relationship itself. This effort eventually resulted in a number of theoretical contributions (Bowlby 1958, 1960a, 1960b, 1961a, 1961b, 1968, 1969, 1973.)

Whereas I had not initially been convinced of the heuristic value of the ethological approach as contrasted with the earlier theory provided by both psychoanalysis and social learning theory (c.f. Ainsworth, 1969), the direct observation of mother-infant interaction and of infant social development in the course of my Ganda study led me to an enthusiastic acceptance of the new paradigm. In turn, the Ganda study was very useful as one of the empirical supports of attachment theory as it has most recently been formulated (Bowlby, 1969, 1973.)

To attempt a capsule statement of attachment theory is grossly to oversimplify it. At the risk of inviting misunderstanding I shall nevertheless attempt such a summary here.

An attachment is an affectional tie or bond that one individual (person or animal) forms between himself and another specific individual. The behavioral hallmark of attachment is seeking to maintain a degree of proximity to the figure to whom one is attached, but attachment is not conceived as vanishing when that figure is absent or during any period in which other competing behaviors for whatever reason override proximity-seeking behaviors. Attachments may be sustained through periods of absence--periods which are brief in early childhood, but which become increasingly longer with increasing maturity. Therefore it is necessary to assume that attachment refers to the propensity of the individual intermittently to behave so as to promote proximity to and interaction with his attachment figure(s)--a propensity that implies internal, central processes which are not themselves directly observable. Attachments are not limited to any specific period of life, but the first attachment to be formed is that of an infant to his mother, and it is with this first attachment that we are primarily concerned.

The ethological-evolutionary view is that infant-mother attachment has a significant biological function in terms of survival value. In the environment in which the species evolved, behaviors that contributed toward the infant becoming attached to his mother, through a process of natural selection, became part of the repertoire of behaviors characteristic of the species and supported by genetic constitution. In the human species, as well as in many other species, an infant is predisposed by the species groundplan inherent in his genetic equipment to become attached to someone--his mother figure, who is usually his natural mother. The behaviors that mediate the development of attachment are themselves species-characteristic and genetically determined. These are behaviors that first merely promote proximity to any conspecific, but then become focused upon and organized around the particular conspecific with whom he has most interaction, the mother figure. These proximity-promoting behaviors are termed "attachment behaviors," although in the human neonate they might best be termed "precursor attachment behaviors" because they antedate the actual formation of an attachment.

Attachment behaviors are of two main classes. The first class consists of signalling behaviors which promote proximity by attracting the adult to approach the baby. Of these, crying is present at birth, and smiling and non-crying vocalization emerge within the first few weeks of life. Later developing modes of communication, both verbal and non-verbal, may also serve as attachment behaviors even though they may obviously serve other behavioral systems too. The second class of attachment behaviors are active behaviors through which the infant himself seeks to gain or to maintain proximity and/or contact. At birth these are limited to a few reflex-like behaviors--rooting, sucking, grasping, and postural adjustment when held. As sensorimotor development proceeds, however, the repertoire of active attachment behaviors expands to include reaching, locomotor approach, clasping and clinging, and the like.

Infant attachment behaviors are preadapted to and interlocked with a reciprocal set of maternal behaviors that bias the mother both to respond to infant signalling behaviors by increasing proximity to or establishing contact with him and to maintain a certain degree of proximity to him on her own account whether or not he happens to be signalling at the moment. Thus both infant attachment behaviors and reciprocal maternal behaviors have the "predictable outcome"--usual or statistically probable, but not invariable outcome--that a degree of proximity between the two members of the pair is maintained.

The biological function of infant attachment behaviors and reciprocal maternal behaviors is held to be protection of the infant. Bowlby hypothesized specifically that in the environment of evolutionary adaptedness--the environment in which the human species originally evolved--protection against predators was the outcome of behaviors that promoted mutual proximity that led these behaviors to be selected. The implication is that, despite the fact that the danger of predation is almost non-existent in many of the environments in which contemporary humans live, the infant is nevertheless programmed by reason of his genetic constitution to emit proximity-promoting behaviors, and to react with considerable urgency should his signals be initially unsuccessful in effecting the outcome for which the behaviors were "designed."

It is only for the first few months of his life, however, that attachment behavior continues to have the reflex-like characteristics that it had in the beginning. A major feature of Bowlby"s attachment theory is his provision that attachment behavior becomes "goal-corrected" and hierarchically organized according to plans. Here he draws upon control-systems theory, and, in regard to plans, upon Miller,Galanter, & Pribam (1960). Goal-corrected behavior is behavior in which a continuous feedback mechanism guides the achievement of a "set-goal." Although the set-goal may be species-characteristic, as indeed he believes maintenance of proximity to an attachment figure to be, the behavior through which the set-goal is achieved or maintained may be flexible and environmentally labile.

To maintain the degree of proximity indicated by the set-goal does not imply that the infant constantly demands contact or even close proximity with this mother. On the contrary, the attachment system is only one of a variety of behavioral systems, which have different conditions of activation and termination, and which may compete with one another. When for example, exploratory behavior is activated by new and interesting stimulus configurations, it may override attachment behavior, inducing an infant old enough to be mobile to decrease proximity to his attachment figure. Nevertheless, the set-goal of the attachment system tends to keep the exploratory behavior within the limits of space and time implicit in its "setting." Thus to have moved away from the attachment figure beyond the distance implicit in the set-goal (or to have remained distant from that figure for longer than the time specified by the set-goal) automatically activates attachment behavior--i.e. behavior that increases proximity to the attachment figure and thus maintains the degree of proximity required by the set-goal.

The set-goal itself may shift from time to time. The emergence of an alarming stimulus, for example, may shift the set-goal from, say, 100 feet to 5 feet--or to the closest possible physical proximity with the attachment figure implied by close clinging. The departure of an attachment figure, or behavior that signals impending departure, may similarly heighten attachment behavior to a level of intensity far surpassing its ordinary maintenance level. Similarly, a variety of internal conditions may activate attachment behavior--hunger, fatigue, illness, and the like. Under conditions of low activation one set of behaviors may perform a proximity-promoting function, but under conditions of intense activation not only may these behaviors become more intense (more prompt, more rapid, or more vigorous) but there may be a shift to another set of behaviors. Thus, for example, an infant while exploring may intermittently look, smile, vocalize, or gesture toward his mother, and occasionally approach her slowly and casually, but if alarmed he may rush to her as fast as he can, and then clamber up and cling, or, indeed, he may merely scream thereby strongly activating her maternal (approach) behavior.

These considerations suggest that research into the development of attachment cannot focus on behavioral systems either in isolation from one another or without regard for the context in which attachment behavior is activated .

My study of Ganda infants led to the following conclusions, which may be considered hypotheses to guide further research, and indeed led to the specific aims that guided the present research project. First, I concluded that there was no single attachment behavior that could serve as a criterion that a baby had in fact become attached to a specific figure (his mother) rather than merely behaving to optimize proximity to conspecifics as he had done from the beginning. I had expected from my knowledge of the literature (e.g. Spitz, 1959) and from my familiarity with the responses of young children to separation from the attachment figure, that separation distress would emerge as the criterion that a baby had become attached. Whereas there is weighty evidence that distress contingent upon a major separation--for days, weeks, or seemingly permanently--indexes attachment, the Ganda study made it clear that not all babies, even those that otherwise seem to be clearly attached, protest minor everyday separations, such as when the mother leaves the room for a few minutes.

If one has the clear-cut impression that a baby is attached to his mother figure despite the fact that he does not consistently protest her departure in everyday separation situations, the question arises as to what behaviors gave the observer the impression that the baby was attached. Thus the second major yield of the Ganda study was a catalogue of behaviors through which a baby mediates his attachment. All of these were "differential" behaviors; the infant discriminated among various figures including a variety of familiar figures, and characteristically directed proximity promoting behaviors more frequently or more readily or more intensely toward one figure rather than toward others. The catalogue began with differential crying, smiling, and vocalization, included protest and/or following when a figure left the room, but also included behaviors in greeting a returning figure, and behaviors manifested in physical contact. It listed also behaviors that are not in themselves attachment behaviors, but which nevertheless contribute to the judgment that an attachment has been formed--for example, using the mother as a secure base from which to explore the world.

Third, a developmental analysis suggested that the development of attachment passed through several phases within the first fifteen months or so, with different constellations of behaviors being conspicuous in each phase. For our purposes here these phases may be reduced to three: (a) an initial indiscriminate phase in which an infant's attachment behaviors are not differential to any specific figure; (b) a phase during which the infant becomes increasingly discriminating and differential, first in regard to figures close at hand and later across a distance, but in which the differential behaviors are for the most part signalling behaviors such as crying, smiling, and vocalization; (c) a phase in which the infant becomes increasingly active in gaining and/or maintaining proximity and contact to a specific attachment figure--a phase in which Bowlby's "goal-corrected" behavior first becomes conspicuous.

Fourth, it was quite clear that there were individual differences toward the latter part of the first year (and later) in the patterning of attachment behaviors manifested by different infants, and that these were significantly related to characteristic maternal behavior. A security-insecurity dimension was identified, and certain maternal behaviors were found to be related significantly to it.

Finally, there was unambiguous evidence that babies may become attached to one (or several) figures other than the mother. The timing of our visits (once every two weeks) made it impossible to establish whether attachment to the mother preceded or was coincident with the formation of other attachments. In any event it was clear that most babies were attached not only to their mothers but also to some other figure or figures--for example, father, maternal grandmother, uncle, or an older sibling.

The details of the Ganda study have been published (Ainsworth, 1963, 1964, 1967.) Furthermore, contributions to attachment theory are represented in publications (Ainsworth 1969, 1972, 1973a, Ainsworth & Bell, 1970).

At this point it would be appropriate to review the literature of mother-infant interaction and attachment behavior. This I do not propose to do--but rather I refer the reader to a review of the relevant literature (Ainsworth, 1973a).

AIMS OF THE PROJECT

The specific objectives of the present project stemmed directly from my study of Ganda infants and mothers (e.g. Ainsworth, 1967) and were directed toward checking and confirming, refining, and extending the findings of that study. The following five objectives were formulated at the beginning of the study in 1962-63 and have guided it throughout.

Objective 1: Normative

To observe and describe the course of development through the first year of life of those behavior patterns which have already been identified as those from which attachment develops, and which later mediate attachment, from their reflex-like origins, through transformations of the behavior patterns themselves, and through growth of differentiation, discrimination and active direction, ending with their coordination together and organized direction toward one person, the mother.

Objective 2: Individual Differences

To examine individual differences in regard to the rate of development and the sequence of emergence of attachment behaviors, and in regard to the configurations of attachment behavior most characteristic of each child.

Objective 3: Organization of Attachment Behavior

To attend especially to the last quarter of the first year in which the separate behaviors are hypothesized to become integrated, hierarchically organized, and directed by plans, and to identify dimensions in terms of which individual differences in such organization may be described.

Objective 4: Influence of Environmental Variables

To examine and assess the influence of environmental variables on the development of attachment behavior, with particular reference to the mother's behavior in interaction with her infant, her methods of infant care, the life space she arranges for him, and the part played by other persons in interaction with him; and to observe changes in these variables that occur from one phase of development to another.

Objective 5: Relationship of the Quality of Attachment to Other Aspects of Development

To assess, at various phases of development, the relationship between the quality of an infant's attachment relationship to his mother and (a) his relationship to other members of the household, and to strangers; (b) his exploration and manipulation of the physical world of objects; and (c) his general sensorimotor development.

To these five objectives may be added a sixth, which was implicit from the beginning although not explicitly stated.

Objective 6: Formulation of Potential Applications

On the basis of the findings of the project, to formulate descriptive principles and guidelines for relevant aspects of infant care in the first year of life, especially as they may be seen to promote healthy social and cognitive development, and to communicate these formulations together with the findings upon which they are based directly or indirectly to those responsible for infant care--parents and other caregivers, and relevant professionals including pediatricians, child psychiatrists and the like.

METHODS

In this section the procedures used in the project to date, both in regard to collection and recording of data and in regard to the substantial amount of data analysis that has already been completed, will be dealt with but briefly.

Subjects

The main sample consists of 26 white, middle-class families obtained through several cooperative pediatricians in private practice, before the birth of the baby. Sixteen of the sample were boys, and 10 were girls. Six were first-born, all of them boys. All but 5 of the mothers were full-time mothers; only one of the working mothers had a full-time job throughout most of her baby's first year. Only one of the families that was approached declined to participate. No family dropped out once participation had been agreed upon.

There were three similar supplementary samples obtained in a similar way who were observed when nearly one year old in a special laboratory situation--the "strange situation" which will be discussed later. Thus 106 subjects in all were available for that aspect of our work.

Schedule of Visits

For the main sample of 26 infants, two preliminary home visits were made, one before the birth of the baby to explain procedures, to elicit cooperation, and to obtain informed consent, and the other as soon as possible after the baby's birth. For the first 15 cases 18 subsequent visits were made at intervals of 3 weeks, beginning when the baby was 3 weeks old, and ending at 54 weeks, with the strange situation substituting for or supplementing the visit at 51 weeks. For the last 11 cases there were 21 visits at 1, 2, 3, 4, and 6 weeks, and thenceforward every 3 weeks as in the first subsample. Except for the earliest visits to the last 11 cases, each visit lasted for approximately 4 hours. This schedule permitted a good sample of routine situations and infant states and, especially after the first few visits, ensured that the mother behaved in a way natural to her. It also provided for approximately 72 observation hours for each subject.

Establishing and Maintaining Cooperation

Special attention was paid to establishing and maintaining cooperation with the families and to safeguarding the welfare and privacy of the participants. Although details will not be given here, and have not been reported in journal articles because of pressure toward brief presentations, policy and procedures relevant to these matters are considered of crucial importance and will be discussed in the major publications (a book and a monograph) that are yet to be finished.

Methods of Collecting Data

Four chief methods of collecting data were used: observation in home visits, interview, observation in the strange situation, and infant intelligence testing. In addition medical records were obtained from the pediatrician.

Observation in home visits. In general the visitor was enjoined to observe as much as possible of what went on during visits, especially what the infant did, and most especially what he did in interaction with his mother, and as much else as he could attend to. Some selectivity and focus was ensured in two major ways: through "event sampling," and through special attention to "critical situations." In addition, a preliminary schedule of observation and interview was drawn up, which detailed the information desired for all cases as an outcome of the total sequence of home visits. This schedule was implicitly expanded and refined in the course of frequent discussions with the visitors about things that it would be interesting and/or valuable to find out about.

The "events" that were to be sampled were primarily infant attachment behaviors, as catalogued by Ainsworth (1967). The observers were set to observe and to record each instance of such behavior and the details of the context in which it occurred. The event sampling method does not, however, take account of negative instances, that is, the non-occurrence of a specific attachment behavior in a situation in which it might be expected. Therefore particular attention was paid to certain "critical situations" in which attachment behavior seemed most likely to be activated or terminated. Sixteen such critical situations were identified, but those to which we have given attention in data analysis are fewer. If a critical situation relevant to the age of the baby did not occur spontaneously during a visit, the visitor was instructed to engineer its occurrence. Moreover, since differential responses were of particular interest, the visitor himself was instructed to participate in each of the critical situations in order to observe the baby's responses to him.

Observers were encouraged to record as much as possible of all that happened during the visit, without "editing" in regard to significance or relevance. This enabled him to free himself of the possibly inhibiting tensions of an overload of instructions about what he was supposed to observe. This combination of previous alerting so that we would notice behavior that he might otherwise overlook, and the play-by-play reporting set which led him to record as much as possible regardless of its perceived significance, has proved to be a helpful way to produce data rich in both detail and relevance.

In the course of the data collection--first during 1963-65 and then during 1966-67--four observer-visitors were employed. I was responsible for five cases. Three research assistants, one female and two male, visited 11, 7 and 3 cases respectively. I made as many joint visits with each observer to each family as I could, although on the average these were limited to one or two such visits per family. Probably at least once per family another visitor substituted for the regular one.

Reliability of observation was a concern, and obviously the joint and substitute visits provided one kind of reliability check. Because of limitations of personnel (and money) there was a conflict between duplication of observations for the purposes of a perfectionistic establishment of degree of reliability and the observation of a sample large enough to support statistically adequate data-analysis procedures. The latter consideration "won." The initial training of observers and their specific instructions ensured, however, that mother-infant interaction was adequately observed and reported, and likewise attachment behaviors and the critical situations that were most relevant to them. The "proof of the pudding" is in the findings. There has been a truly impressive yield of significant findings from the project to date. With any undue amount of random observer error it would have been impossible to have obtained this yield of significant findings. Furthermore it is inconceivable that any systematic observer bias could have yielded the highly complex but nevertheless psychologically meaningful sets of intercorrelations between variables that have been obtained. Therefore, although the constraints placed upon us prevented the kind of reliability checks and assurances that are possible in projects of substantially smaller scope, I am confident that the findings are free from significant distortion by observer error or bias.

Interview information, obtained from the mother and from other relevant adults in the household, included information that could not be obtained through direct observation--demographic data, descriptions of family background, night-time routines, special events occurring between visits, and also the informant's view of the events observed during visits. The interview methods were largely non-directive. Much information emerged spontaneously from the mother's comments in the course of other activities, but open-ended questions were asked when the desired information did not emerge spontaneously. Relatively little use of interview information has been made in our data analyses to date; observational data have been emphasized.

Observation in the strange situation. As already noted, the babies of both the main longitudinal sample and of other samples were introduced to a controlled laboratory situation toward the end of the first year. The chief purposes of this were: to assess the extent to which a baby could use his mother as a secure base from which he could explore an unfamiliar situation and from which he could face a possibly fear-arousing stimulus object (a stranger), and also to observe his response to brief separations from his mother and to reunion with her afterwards. The environment, the sequence and duration of episodes, and the roles of the mother and the stranger were controlled, so that this may be viewed as a standardized situational test--and as such it has proved to be both powerful and useful. An account of the procedures is reported elsewhere (Ainsworth and Wittig, 1969; Ainsworth and Bell, 1970; and Ainsworth, Bell, and Stayton, 1971) and will not be repeated here.

Infant intelligence testing. The Griffiths' (1954) Infant Intelligence Scale was administered to all subjects in the main sample approximately every 9 weeks.

Pediatrician's records included particulars of the neonatal examination; height, weight, and cephalic measures taken at regular intervals during routine examinations; routine notes and dietary prescriptions; and particulars of any illness and its treatment.

Methods of Recording Data

Narrative records. The narrative record of a home visit included both interview material and a continuous record of observation. On the basis of continuous notes made during the visit, it was dictated by the observer as soon as possible afterwards, and subsequently transcribed. The observer was instructed to indicate five-minute intervals in his record; he was also instructed to time more precisely special events such as the duration of a cry. The narrative report was dictated according to a standard format, following a detailed set of instructions.

In the strange situation two observers, viewing the infant (with mother and/or stranger) in the next room through one-way vision windows, dictated independent narrative records into tape recorders. A time signal, emitted every 15 seconds, was picked up by the recorders. Subsequently both accounts were transcribed in parallel.

Film records. Movie records were taken for 11 subjects of the main sample in the strange situation. Later a sample of 10 minutes of strange-situation behavior was filmed for 24 additional subjects.

Methods of Analysing Data

The first task of data analysis is to transform the mass of detail contained in the narrative records into manipulable form which orders the data, and makes subsequent use of quantitative analysis possible. This first level of data analysis is very difficult and very time consuming, and yet it can be very rewarding in that it permits of discovery. Instead of selecting behavioral variables in advance and time-sampling their occurrence, rating them, or otherwise assessing them through predetermined instruments, the researcher who uses narrative records has the opportunity of discovering which behavioral variables best order his data--and these may well be quite different or at least differently defined than any he might have thought of before beginning his observations. Indeed, we did draw up one set of rating scales in advance for assessing maternal behavior; although these served a useful purpose in guiding observations, they were later discarded in favor of a new set of scales with the dimensions defined in terms of behaviors as actually observed.

Three main kinds of data-analysis procedures have been used for the first-level analysis in our study: classification, rating, and coding.

Classification has proved to be a very useful and sensitive first step in the analysis of these complex data. The first classificatory system dealt with infant behavior in the strange-situation--which may be conceived as the outcome of mother-infant interaction experienced throughout the first year as assessed in a standardized situation. The classification was based on clustering of cases showing a "by eyeball" similarity. This procedure highlighted the behavioral variables which actually differentiated the cases originally sorted on a more global basis. These variables included at least two that had not been anticipated in advance, and indeed which proved to be the most valuable of all in differentiating qualitative aspects of the infant-mother attachment relationship (i.e., avoiding and resisting behaviors), and excluded one that might have been believed in advance to be the most significant of all, (i.e., crying in the separation episodes of the strange situation). Further procedures for handling the strange situation data followed from this: (a) the devising of a scoring system for measuring the variables crucial to the classificatory system, (b) a discriminant analysis that used these scores as a basis for checking the discrimination claimed by the classificatory system, and (c) a factor analysis to identify the main dimensions implicit in the variety of behavioral scores.

Meanwhile reliability of the strange-situation classification was checked. In one check, for example, two judges, working independently, agreed completely in the classification of 31 of 33 cases. In one case they differed in regard to subgroup placement but agreed in group placement. In another case (clearly borderline) they disagreed in group placement.

The strange-situation classificatory system has proved to have great further usefulness within the present study. For example, a quick reading of the narrative records was undertaken to gain impression of ways in which the different strange-situation groups and subgroups differed in regard to the behavior of both mother and infant at home in the fourth quarter of the first year. This led to the tentative identification of four dimensions of maternal behavior that seemed associated with different strange-situation outcomes, and rating scales were devised to measure these. Furthermore, it seemed likely that infant obedience was clearly related to the quality of infant-mother attachment (as reflected in the strange-situation classifications) and so a coding system was set up to investigate this relationship and a separate analysis was undertaken of individual difference in infant obedience (Stayton, Hogan, and Ainsworth, 1971). Finally, in several analyses of specific attachment behaviors the clue to the dynamics of individual differences was to be found in contrasting strange-situation groups with respect to these behaviors.

A second classificatory system dealt with mother-infant interaction in the feeding situation in the first quarter of the first year. Not only were the classifications thus derived very useful in describing individual differences in feeding interaction, but they were found to be related to a number of other measures of infant and maternal behavior including strange-situation classifications at the end of the first year (Ainsworth and Bell, 1969). Methodologically speaking, however, the classificatory system enabled us to identify four main variables on the basis of which maternal behavior relevant to feeding could be described, and assessed through rating scales.

A third classificatory system dealt with the balance between exploratory and attachment behavior manifested by the infant at home during the fourth quarter of the first year. This was found to yield results highly congruent with the strange-situation classifications (Ainsworth, Bell, and Stayton, 1971), but its chief value was to direct attention toward the significance of subtle nuances in physical-contact interaction as being highly significant in understanding how different organizations of attachment behavior arose.

This much space has been devoted to the issue of classification as a procedure for two reasons. First, classification has been dismissed by many contemporary researchers as subjective, unreliable, and unscientific, whereas our use of classification shows that this is not necessarily the case. Second, I wished to indicate how analysis of complex narrative data can proceed flexibly by levels of approximation (Lewin, 1940), first with gross qualitative distinctions, which could gradually give place to the identification and refined measurement of behavioral variables, which could finally be subjected to multivariate analysis. The advantage of the preliminary impressionistic, "by eyeball" classificatory approach is that one can gradually hit upon and define the variables that are most likely to represent the behavioral dimensions and the interrelations among them that are implicit in the data. The multivariate statistical analyses then are not so much blind methods of discovery of interrelationships as confirmations of interrelationships already suspected to exist. Furthermore, one cannot expect multivariate analysis to yield significant or scientifically useful results if the original variables that yield the intercorrelations upon which it is based are diffuse, noisy, or working across the behavioral dimensions that are actually implicit in the data.

Rating scales. The rating scales devised in this study are perhaps maligned by being called rating scales. They are far more than a labelled behavioral dimension in regard to which a rater is asked to make judgements of very, very high, moderately high, average, moderately low, low and very low. They are either 9-point or 7-point rating scales in which every other scale point is given a detailed behavioral definition, and in which the dimension as a whole is carefully delineated by initial instructions.

Our chief use of rating-scale procedures has been to assess maternal behavior in interaction with the infant, whereas for infant behavior we have relied chiefly on measures derived from coding. Two chief sets of rating scales have been devised to date.

The first set deals with maternal behavior pertinent to the infant's first quarter-year, and consists of 22 rating scales. These scales represent revisions of the a priori scales mentioned earlier, and were constructed after first quarter behavior had been observed. They include 4 scales describing the mother's general attitude toward the baby and her role, 4 scales relating to feeding interaction, 4 relating to mother's availability to and interaction with her baby, 2 dealing with physical-contact interaction, 1 concerned with the effectiveness of mother's response to infant crying, 4 relating to social contact, and 3 to facilitation by the mother of sensorimotor development.

The procedure for rating was as follows: two or more judges rated each mother, each judge rating in sequence the 4 (or 7) relevant visits in the first quarter, and then finding a median. The ratings for each case were then conferenced, and a final conferenced rating was decided upon, which was usually the median of the two (or more) medians. It may be noted that each judge rated all 22 variables at a time--the fastest possible rating procedure which still provided a reliability check. The inter-rater agreement of each of these 22 rating scales was checked, and in all but a few instances was found to be within satisfactory limits, with coefficients of .80 or higher. And of course the final conferenced rating may be presumed to be a more stable (and presumably more reliable) figure than even the findings of high inter-rater agreement might suggest.

The second set of rating scales was devised to measure maternal behavior in the infant's fourth quarter-year. The four variables had been chosen and defined in terms of the preliminary impressionistic analysis (mentioned above) of variables that distinguished among strange-situation groups and subgroups. These variables were as follows: sensitivity-insensitivity in response to infant signals and communications, acceptance-rejection, cooperation-interference, and accessibility-ignoring. The following rating procedure was used. Five judges were utilized, three of whom were ignorant of any other assessments that had been done previously. Each judge rated one visit to one case, and then passed on to another case. Only after a lapse of time, and having surrendered previous sets of ratings to the research secretary, did he rate another visit to the case in question. At most two variables were rated at a time. As before, the final rating was settled in conference, and was nearly always the median rating for all judges for all visits rated.

Inter-rater agreement was satisfactory for the four variables. The mean correlation coefficients for pairs of judges were as follows: sensitivity-insensitivity .89, acceptance-rejection .88, cooperation-interference .86, accessibility-ignoring .87.

A few other rating scales have been devised for special purposes, when data analysis suggested a variable that required assessment. For example, the analysis of infant crying data suggested that it would be useful to have a measure of the excellence (variety, sublety, and clarity) or infant communication in the fourth quarter, and a rating scale was devised for this purpose. In this case it emerged that narrative data were not even enough in the degree of detail reported to make it possible to make reliable distinctions on the 7-point rating sclae that was originally devised, but when this was collapsed into a 3-point scale it proved to be useful, and reliable.

Coding. Although classification may be considered a first-level procedure and rating of the variables derived from it a second-level procedure, coding procedures cannot be fitted so conveniently into a levels-of-approximation model.

At the outset it had been intended to code a wide variety of "critical situations" as well as infant crying behavior. Coding proved to be enormously time-consuming, and both because of this and because a number of our critical situations focused on looking behavior which is perhaps not properly identified as an attachment behavior, we have narrowed down to the following:

among infant attachment behaviors, crying, and approach to a person; among "critical situations," adult picks baby up (and perhaps holds him), adult puts baby down, adult and baby come into a face-to-face confrontation, adult leaves room, adult enters room, adult issues a verbal command or intervenes physically to control infant behavior, and finally, adult and baby engage in interaction across a distance. Of these, infant approach behavior, adult commanding and physical intervention, and infant-adult distance interaction coding were undertaken only after other data analyses had indicated their desirability.

Each behavior or situation required a specific set of operations in coding. Let us take the coding of crying as an example. Each instance of crying during a visit was recorded on a coding sheet with the following information being provided: time of onset of the cry, time elapsed since last feeding, state of baby prior to the cry, circumstances before the onset of the cry, relationship to present routine, environmental circumstances immediately preceding the cry, type and duration of the cry, other concurrent infant behavior, adult behaviors in response to the cry and their latency, infant's response to each of these interventions, intervention which terminated the cry; time at which the cry was terminated, and baby's state and behavior after the crying episode is over.

Even in the case of codings that were planned from the outset of the research, modifications of the coding systems had to be made in the light of experience in applying it to the narrative data. Furthermore, in each instance, the analysis of the findings yielded by the codings required addenda to the coding (or expansion or refinement of the analysis) in order to answer new questions suggested by the data themselves. Therefore, even in the most "objective," detailed, and exhaustive of our data-analysis procedures we have had to work through levels of approximation from relatively crude to progressively more incisive and refined measures.

For the most part the coding has been undertaken by non-professional personnel and by undergraduate student volunteers, who were without effective knowledge of our hypotheses, and without any knowledge of the findings of other data analyses. Training of coders and routine reliability checks were undertaken conscientiously and were considered especially important in view of the multiplicity of student volunteers who participated in this tedious work. These checks resulted in corrections, and only when the work of a coder survived several reliability checks without correction being required was he allowed to proceed independently. A further check came when the codings were further analysed. If in the course of analysis, omissions or ambiguities were noticed, the original narrative reports were checked. If any coder were found to have become careless his coding was checked throughout and corrected. The criterion was straightforward--fidelity to the narrative record.

Coding does not result directly in findings. A flexible and creative professionally-trained researcher is required to decide what measures can best be derived from the coding and to define these precisely. Furthermore, as implied above, the completion of the analysis of a set of codings may suggest further desirable measures that require reworking the codings, and in some instances, new codings of the narrative reports.

Two final points should be made about coding of the narrative records of the home visits. First, coding is so enormously time-consuming that we had to be highly selective in regard to the choice of behaviors or situations to be coded; if careful rating procedures of the type described above would suffice, they were chosen in preference to the more expensive coding procedures. Second, although a coding procedure appears to be less vulnerable to errors of judgment than do rating or classificatory procedures, it cannot always be the method of choice. For variables based on a variety of specific behaviors the more "integrative" judgment of ratings or rating-like scoring systems were sometimes preferable. In regard to the details of the measures derived from coding, it seems best to defer description until the discussion of findings--or to refer to the appropriate publications in which they are described.

A special word should be said about coding strange-situation behaviors. Two types of coding emerged from this analysis. The first was straightforward--it resulted in frequency measures (behavior per 15" interval) of crying, exploratory locomotion, exploratory manipulation, visual exploration, visual orientation, smiling, vocalization, and oral behavior. The second coding was more complex, and indeed might be described as a scoring system rather than a coding system for the following behaviors--proximity and contact seeking, contact maintaining, proximity and interaction avoiding, contact and interaction resisting, and distance interaction in regard to each the mother and the stranger, and search behavior in the separation episodes. This scoring system took into account different behaviors with the same goal, involving different degrees of active initiative, different frequencies and/or durations of such behavior, and also allowed for contingencies of adult behavior. All relevant behaviors for each child in each episode of the strange situation were recorded, then arranged to define a 7-point scale.

Inter-coder agreement for frequency codings was checked for two coders for eight randomly selected cases. Correlation coefficients were as follows: exploratory locomotion .99; exploratory manipulation .93; visual exploration .98; crying .99. Inter-scorer agreement for other behaviors directed toward the mother was checked for two coders of 14 randomly selected cases. Correlation coefficients were as follows: proximity seeking .93; contact maintaining .97; proximity avoiding .93; contact resisting .96; search .94.

One final word needs to be said about our first-level (and second-level) analyses. It is easy enough for us to describe in detail the measures that are implicit in our rating scales and in the variables derived from coding, as well as the bases of classification that have been used. It is not possible, however, to give a detailed account of the measures that we will use in analyses that have not yet been tackled. I hope that I have said enough about the way in which data are approached, with both identification of appropriate variables and measures thereof resulting from data analysis rather than preceding them, to make clear to the reader that this is a productive way of going about analysis of narrative records. Furthermore, may I point out that we are pioneers in this field, and the yield of our research to date suggests to us that we are going about it in a useful way. Therefore, in regard to further data analysis that is planned for the period for which support is requested, please do not expect a detailed account of the measures we intend to use or how we intend to treat these statistically. We have yet to identify the variables to be measured, and then need to work out the measures that will assess them. This can not be done a priori.

Statistical Analyses

A wide variety of statistical analyses have been used in processing the data of this study, some of them simple and some more complex. Among the simple analyses are comparisons in terms of t tests, chi square, and occasionally analysis of variance. In addition we have made extensive use of correlational techniques. Perhaps none of these require special comment. We have also used, however, more complex multivariate techniques, and these perhaps do require comment in view of the fact that our sample is small (at least the longitudinal sample) and our variables are numerous. We view our use of multivariate techniques as methods of analysing our data that enable us to comprehend the interrelationships of multiple variables, and do not claim that findings from this small sample can generalize to basic "factors" in human nature. Furthermore, were it not for the fact that our measures (being based on relatively many observation hours spaced out over an extended time) are relatively stable, we could not have obtained as many significant and substantial correlations as we have obtained. And had we not obtained so many significant correlations multivariate techniques would have been much less relevant and useful than they have proved to be.

FINDINGS TO DATE

Here I shall in summary form attempt to present the findings of the research to date, referring to reprints and preprints of publications for details, but including here some important details of analyses that have not yet reached even a preprint stage. The summary of the findings will be presented relevant to the five objectives of the study as outlined on pp. 7-8.

Objective 1. Normative

This objective implies a description of the course of development throughout the first year of each of the behaviors that can be identified as attachment behaviors. Their onset is of interest, and also the onset of differential direction of the behavior toward different figures.

Seven analyses of data, some completed and some nearly complete, are relevant to this objective. Six of these are specific--namely, the analysis through coding of the following behaviors: crying; behavior relevant to physical contact; protest and following in leave-room situations and greeting in enter-room situations; smiling and vocalization (and also looking and other behaviors) in face-to-face situations; smiling, vocalization, and gestures in distance interaction; and locomotor approach behavior. The seventh analysis is more general; it is a comprehensive longitudinal analysis of all attachment behaviors; it is not yet complete. Let us consider each of these in turn.

Crying. (See Bell and Ainsworth, 1972.) Episodes of crying were found to occur at a median frequency of 4 per hour throughout the first year, with no significant decline. Duration of crying, expressed in minutes of crying per waking hour, decreased from a median of 7.7 minutes per hour in the first quarter to 4.4 minutes per hour in the fourth. The range was very wide in the first quarter (from 21 minutes per hour to almost none at all) but narrowed considerably by the fourth quarter. The proportion of cries emitted under three conditions of proximity was considered. In the first quarter babies cried much more frequently when not in proximity with the mother (out of sight and out of earshot) than when in proximity to her (could hear and see her), and three times as often when out of proximity than when in actual physical contact with the mother. This suggests that the condition of being alone either itself activates crying or at least contributes to its activation. In the fourth quarter, however, babies cried more frequently when in proximity to the mother than they did when either alone (not in proximity) or when in physical contact with her. This suggests that toward the end of the first year crying is becoming to some extent a mode of communication directed toward a specific figure rather than emitted entirely expressively. Indeed a comparison of frequency of crying episodes and their duration confirms this conclusion. Since the frequency of crying episodes scarcely declines throughout the first year, while the duration of crying declines markedly, the implication is that many of the cries at the end of the first year are brief signals rather than expressions of great distress.

Crying when mother leaves room (i.e., separation distress). (See Stayton, Ainsworth and Main, 1973.) Whereas crying is present from birth, crying when mother leaves the room does not appear until later. We found it to appear at a median age of 22 weeks--substantially earlier than in any other study, except for my Ganda study (Ainsworth, 1967)--presumably because my findings were based on direct observation rather than on interview. Although separation anxiety or distress has been assumed by Spitz (1959), Schaffer and Emerson (1964), and others to be the criterion of attachment, we found this behavior to be relatively infrequent throughout the first year. Infants were found to cry in 17.8% of all mother-leaves-room episodes in the second quarter, 27.0% in the third quarter, and 22.5% in the fourth quarter. This relative infrequency suggests that crying when mother leaves the room cannot serve as a satisfactory single criterion of attachment, but rather, as Ainsworth (1963, 1967) suggested, multiple criteria are required.

A detailed developmental picture of this behavior shows two peaks in a frequency curve--once at 30 weeks and again at 48 weeks. We hypothesize that developmental changes in cognitive ability make early separation protest somewhat different from later separation protest in terms of internal dynamics. Crying when a figure leaves the room was found to be a differential behavior from its onset, as judged from comparing responses to the mother leaving to responses to either siblings or an unfamiliar figure leaving the room. Being left alone, however, was found to be more distressing than being left in company, and to occur at an earlier age than the onset of crying when a specific figure left the room.

Following when mother leaves room. (See Stayton, Ainsworth, and Main, 1973.) Infants, once capable of locomotion and when free to follow, did in fact follow the mother when she left the room more frequently than they cried. The peak for following occurred at 48 weeks of age, at which time following occurred in 58% of leave-room episodes. In the fourth quarter as a whole it occurred in 47.5% of leave-room episodes. The mean onset of following was placed at 30.9 weeks, three weeks after the onset of locomotion. By six weeks after the onset of locomotion, following was frequent, and remained so for the rest of the first year. Babies were found to follow their mothers much more frequently when left alone than when left in company. On the other hand we found no significant evidence of following being differential to the mother--perhaps because babies when in an affiliative or exploratory mood and not under stress tend to follow figures whom they find interesting. Under stress, however, as in the strange situation, babies are clearly differential to attachment figures (here the mother) in their attempts to follow departing figures.

Greeting when mother enters room. (See Stayton, Ainsworth, and Main, 1973.) In our initial analysis we distinguished between positive greetings (smiling, vocalizing, bouncing, reaching, leaning, waving, and/or approaching), negative greetings (crying), and mixed greetings (crying combined with some element of positive greeting). The age of onset of greeting the mother across a distance was clearly earlier than crying when separated; it occurred at a median age of 16.3 weeks. Negative and mixed greetings had a later onset at 27 weeks, and were much less frequent. They occurred in only 6% and 2% of enter-room episodes in the last three quarters of the first year, in contrast with positive greetings that occurred in 30% of such episodes.

Surprisingly, the frequency of positive greetings was not found to be differential to the mother. This led to two additional analyses--one of intensity of positive greetings, and the other an analysis of the components of positive greetings. Intensity of positive greeting was found to be significantly greater to the mother than to unfamiliar figures. Smiling, the most frequent component of positive greeting, was found not to be differential in incidence to mother versus strangers. But other components of positive greetings were found to be differential--vocalization, reaching, leaning toward, and locomotor approach. While confirming these latter behaviors as differential attachment behaviors, this analysis suggests that smiling (which is undoubtedly a proximity-promoting, precursor attachment behavior) either remains or soon becomes also an affiliative behavior that can mediate interaction with relatively unfamiliar figures.

Behavior relevant to physical contact. The initial approach to an analysis of behavior relevant to physical contact was through coding of "critical situations"--when the baby was picked up (and perhaps held) and when he was put down. It was anticipated that the pick-up (and hold) codings would in the early months yield information about the baby's postural adjustment to being held, and during the latter half of the first year would highlight active behaviors such as "scrambling" over the mother to explore her face and person, burying the face in mother's lap, and clinging--behaviors that had emerged as conspicuous in the Ganda study. It was also expected that a few other well-defined patterns of behavior might be identified--such as embracing and kissing--even though these had not been observed among the Ganda.

As it turned out, the pick-up and put-down coding analysis yielded as first-level behavioral variables six classes of behavior, identified in terms of either manifest affect or intent. Those classes that comprehend attachment behaviors are: positive responses to being picked up and held, negative responses to being put down, and positive initiations of being picked up. The other three classes of behavior may perhaps be viewed as behaviors antithetical to attachment behavior in that they may tend to decrease contact and proximity rather than facilitating it: negative responses when picked up and held, positive responses to being put down, and initiations of being put down. Although this first level coding analysis does not squarely tackle the question of identification of specific attachment behaviors and tracing their development, it has been pursued because of its relevance to individual differences and the development of different patterns of organization of the attachment relationship.

Ainsworth, Bell, and Stayton (1972) provided a preliminary report of the analysis of pick-up, hold, and put-down situations, which was confined to the first and fourth quarters. Now the analysis of second- and third-quarter behavior is complete and findings for the entire first year are being prepared for publication by Blehar, Bell, and Ainsworth. Positive responses to being picked up and held (i.e., when the baby was described as happy, or as manifesting active attachment behaviors such as hugging, clinging, "sinking in," exploring the mother's face or person, and the like) were relatively infrequent in the first quarter, occurring in only 15% of pick-up episodes; "neutral" responses were much more frequent--merely accepting being picked up and held. Positive responses were most frequent in the second (36%) and third (40%) quarters. Negative responses to being picked up and held included beginning to cry, or resisting contact by squirming, stiffening, pushing away, hitting, biting, and so on. These responses (most usually merely crying or stiffening) were relatively infrequent throughout, and remained at a fairly constant level--20%, 18%, 18%, and 12% for the four quarters respectively. If the baby was already crying when picked up it was of interest to assess how easily he was soothed by the ensuing physical contact. In the great majority of such instances the baby did indeed stop crying when picked up--79%, 77%, 76%, and 86% in the four quarters respectively.

Negative responses to being put down (i.e., crying when put down or gesturing to be picked up again) occurred in nearly half (45%) of put-down episodes in the first quarter, declined to 32% in the second quarter and remained at about that level throughout the rest of the first year. Positive responses to being put down occurred but rarely in the first quarter (8% of put-down episodes) but increased substantially thereafter until by the fourth quarter they occurred in 62% of put-down episodes. In half of the fourth quarter instances of a baby responding positively to put-down, he promptly engaged in independent exploratory activity or play. Initiations of pick-up (i.e., when a pick-up episode was preceded by the baby's spontaneous reaching, locomotor approach, or actual clambering up) did not appear until the second quarter, and even then were very infrequent (3%). Even in the fourth quarter only 18% of pick-ups were initiated by the baby's active attachment behavior. Initiations of put-down (e.g., when a put-down was preceded by a baby's squirming) were very rare indeed--2% in the third quarter and 3.5% in the fourth.

In summary, these findings are generally supportive of the role assigned to physical contact by attachment theory. Physical contact tends to terminate attachment behavior, as shown by the high proportion of instances in which it terminates crying. Although babies, especially in the first quarter, may not show marked indications of positive affect when picked up, it never-the less seems to be what they "want." They accept physical contact readily and are very unlikely to take initiative to terminate it. Indeed, at first they are very likely to protest the cessation of physical contact. On the other hand, this state of affairs is of relatively short duration, and by the last quarter babies are much more likely to respond positively to the cessation of contact than to protest it. On the whole the initiative for instituting and for terminating physical contact lies with the mother--at least in our culture, where indeed the baby can scarcely gain close physical contact merely on his own initiative.

Behaviors in face-to-face situations. The analysis of face-to-face situations is in an advanced stage, but up to this point only the first quarter analysis has reached the point that it can be readied for publication. Obviously we must wait for the completion of the second- and third-quarter analyses to be able to give developmental trends for smiling and vocalization in face-to-face situations. Nevertheless, very interesting findings have emerged from the first-quarter analysis alone. (Blehar, Lieberman, and Ainsworth, in preparation.)

This analysis distinguished three groups in accordance with their behavior in the strange situation at the end of the first year: a secure-attached group (Sub-group B_3), an insecure-attached group (Groups A and C), and an intermediate group (Subgroups B_1 and B_2). The primary differences between these groups will be reported later (see pp. 44-46), but here let us consider some of the findings relevant to the emergence of differential responses. Vocalization in face-to-face situations was sharply differential to the mother for the group of infants who were later identified as securely attached, while those later identified as insecurely attached were not significantly differential in regard to this behavior. The frequency of smiling in face-to-face situations approached significant differentiality to the mother in the group later identified as securely attached, whereas the insecure group were not more likely to smile at the mother than at an unfamiliar person. Intensity of response in face-to-face encounters was significantly differential to the mother for the secure-attached group, but not for the insecure-attached group.

Behaviors in distance interaction. Although the basic coding has been completed for distance interaction, the analysis of the coding has suggested that refinements of some of the variables are desirable, and this will necessitate working through the coding again to make the desired differentiations. Therefore nothing can be said at this time about the findings.

Approach behavior. Although approach behavior had been included in the leave-room coding analysis (i.e., as following) and in both enter-room and pick-up analyses, it was obvious that much significant approach behavior was not comprehended in these analyses, as for example when an infant in the same room with his mother came closer to her without this increase in proximity resulting in a pick-up. Therefore, very recently it was decided to undertake a new coding procedure specifically focusing on locomotor approach. The median onset of locomotor approach was found to be 31.5 weeks, with a range from 22.5 to 42 weeks of age.

Locomotor approach was found to be significantly differential to the mother in distinction to an unfamiliar person for the sample as a whole,

($p < .03$) despite the fact that one-third of the infants approached the unfamiliar visitor more often than the mother in the fourth quarter. Two types of approach were found to be highly differential to the mother, however. The first was when the approach was preceded by distress. Of 51 approaches that occurred in the sample, only one was directed to an unfamiliar person ($p < .001$). The other was when the approach was accompanied by clear indications that the baby wanted to be picked up. In the third quarter 28% of approaches to the mother included a pick-up wish, and 32% in the fourth quarter did so. Of a total of 143 approaches of this sort, only 7 were directed to an unfamiliar person ($p < .001$). Thus, although some babies who are attached to their mothers give no indication of differentiality in their approach behavior under non-stressful circumstances, infants show clear preference for the mother when distressed, and when they desire to terminate the approach with close physical contact.

These findings are clearly congruent with attachment theory. They further suggest that mere proximity or proximity seeking in non-stressful circumstances is not an adequate single criterion of attachment. Tracy, Lamb, and Ainsworth are preparing this analysis for publication.

The longitudinal analysis. Despite the obvious virtues of coding as a procedure for processing complex narrative data into quantitatively manipulable form, it has a number of disadvantages. One of these is that behaviors that occur only rarely tend to be combined for statistical purposes with other behaviors that are similar in some ways. For example, a wide variety of specific behaviors were clustered together as constituting "positive greeting behaviors," and only later did it seem essential to examine the component behaviors separately in regard to onset and differentiality. Similarly, attachment behaviors occurring in the context of physical contact tended to be lumped together as "positive responses to being picked-up." One of the objectives of our longitudinal analysis is to identify patterns of behavior (for example, in regard to physical contact) but not limited to behaviors classifiable as attachment behavior to provide a description of these, and to indicate the context in which they were most likely to appear. The longitudinal analysis (which will be described in more detail later) has been completed for 19 cases, with 7 cases yet to be done.

Objective 2. Individual differences

The chief measures through which individual differences may be explored are the same, of course, as the measures through which group trends are assessed. There are two major types of finding relevant merely to the description of individual differences.

The first of these pertains to measures of scatter around each of the normative measures of central tendency. Thus, for example, our analysis of crying (Bell, & Ainsworth, 1972) indicated that the duration of crying had a range in the first quarter from nearly none at all to 21 minutes per hour, but that this range narrowed somewhat in the course of the first year. Frequency of crying episodes, on the other hand, had a range from 10 to less than 2 episodes per hour in the first quarter, but this range decreased but slightly in the course of the first year. Similar information is available for each of the other measures derived from coding, but these findings as isolated facts are not very interesting.

It becomes more interesting to trace the consistency of individual differences throughout the first year. This has so far been done for the following measures: frequency and duration of infant crying, responses relevant to separation, and responses relevant to physical contact.

Cross-quarter correlations of frequency of crying episodes were below the level of statistical significance, except for the correlation between third- and fourth-quarter behavior, which was .43. Similarly, in regard to duration of infant crying, only the correlation between third- and fourth-quarter behavior was statistically significant (.39). These findings do not support an hypothesis that constitutionally determined physiological differences give rise to individual differences in irritability that are consistent throughout the first year. Rather, they suggest that it is only toward the end of the first year that babies tend to develop fairly consistent, idiosyncratic crying characteristics--and it is obvious that even these tendencies are minimally significant. (See Bell and Ainsworth, 1972.)

In regard to separation-related behaviors, the same finding emerged for crying when the mother left the room. It was only the third vs. fourth quarter correlation that was significant (.41). Following could not be tested for stability since it emerged relatively late in the third quarter. Positive greetings to the mother in enter-room episodes tended to be more stable over the quarters in which they were measured, showing a coefficient of .37 between 2nd and 3rd quarter measures (slightly short of significance at the .05 level) and coefficients of .40 between second- and fourth- and third- and fourth-quarter behavior. None of the cross-quarter correlations for crying in enter-room episodes or for mixed greetings (combined) were significant, but this was not surprising in view of the fact that these responses were very infrequent either separately or in combination. (Stayton, & Ainsworth, 1973.)

In regard to behaviors relevant to physical contact, there is somewhat more stability, perhaps because the measures are based on a composite of behaviors rather than upon one isolated behavior--and in this they resemble the measure of positive greetings in enter-room situations. In any event, second-quarter positive responses to being picked up and held are strongly correlated with third-quarter positive responses (.80), and also with fourth-quarter measures (.72) while third- and fourth-quarter responses are also strongly correlated (.74). It may be noted, however, that first-quarter responses are not significantly related to behaviors in any of the subsequent quarters. It appears that an infant does not stabilize his positive responses to physical contact until sometime after the first three months of life have passed, and this further suggests that it is an infant's experience in physical contact that sets the pattern rather than any innate, constitutional determinant. Similar findings emerge for negative response to being picked up and held, further confirming the above-reported findings. Similarly, babies' positive responses to being put down in the first quarter have zero correlation with responses to put-down in subsequent quarters, but second- and third-quarter positive responses are correlated strongly (.80), and third- and fourth-quarter responses are also significantly correlated (.41). Negative responses to being put down follow the same pattern, although in each case the correlations are less (indeed short of significance) than in the case of positive responses to put-down. (Blehar, Ainsworth, & Bell, in preparation.)

Thus, in summary, our findings to date do not support the hypothesis that constitutional differences in the initial strength of attachment behaviors account for later differences in these behaviors in the latter half of the first year of life. On the other hand, and this will be discussed further in a later section, the weight of the evidence in the present study suggests that differences in maternal behavior and hence in mother-infant interaction are very much more potent than initial constitution in determining the strength, frequency, and organization of both attachment behaviors and other behaviors that enter in to determine the quality of the infant-mother attachment relationship.

Objective 3. Hierarchical Organization of Attachment Behavior

This third objective involved special attention to the last quarter of the first year, to see whether (and, if so, how) attachment behaviors become integrated, hierarchically organized and directed by plans, and to identify dimensions in terms of which individual differences in organization might be assessed. The three main approaches have been: a factor analysis of fourth-quarter behavior at home, an assessment of the balance between exploratory and attachment behavior at home, and a series of analyses of behavior in the strange situation at the end of the first year.

Factor analysis of infant behavior at home. Stayton and Ainsworth (1973) reported a preliminary factor analysis of fourth-quarter behavior at home--based on a matrix of intercorrelations that was incomplete because it did not include any measures of behavior involved in interaction across a distance. Two factors were found that accounted for 58% of the variance. The highest loading on Factor I was found for crying when the mother leaves the room, with a positive loading of .875. Other variables with substantial positive loadings were frequency of crying, duration of crying, and negative and mixed greetings when the mother enters the room. Negative response to being put down was also loaded positively. Variables with substantial negative loadings were positive greetings to the mother when she enters the room and positive response to being put down. Positive response to being held was also loaded negatively. We interpret Factor I to represent an insecurity-security dimension of the infant-mother attachment relationship. At its positive pole this factor seems to reflect a baby's anxiety about his mother's accessibility and responsiveness.

Factor II is clearly related to response to physical contact. The measure with the highest loading was negative response to being held with a loading of .631. Initiation of being put down also had a high positive loading, as did duration of crying. The measure with the highest negative loading was stopping crying when picked up (-.635). Other variables with high negative loadings were initiation of being picked up and positive response to being put down, while positive response to being put down had a moderate negative loading. Factor II seems to reflect the degree of distress or ambivalence versus enjoyment an infant experiences in physical contact with his mother.

It is my opinion that the addition of further behavioral measures will not disturb Factor I, and that a security-insecurity dimension will be confirmed as the first important qualitative dimension of the infant-mother attachment relationship--one that was indeed suggested by the study of Ganda babies (Ainsworth, 1967). The addition of further measures may affect Factor II or possibly yield a third factor. My hunch is that negative response to physical contact reflected by the positive pole of Factor II will prove to be related on one hand to the avoidant, defensive behavior shown by some infants in the strange situation at one year of age, and on the other hand to maternal rejection--rejection that is expressed perhaps primarily through behavior when in physical contact.

Attachment-exploration balance. Another approach to the organization of attachment behavior in the fourth quarter of the first year consisted of an assessment, through a classificatory procedure, of the balance between exploratory and attachment behavior shown at home (Ainsworth, Bell, and Stayton, 1971).

It had been expected that some infants would emphasize exploratory behavior at the expense of attachment behavior, that others would emphasize attachment behavior to the disadvantage of exploratory behavior, but that the majority would have a healthy balance between the two. As it turned out, a few infants emphasized exploratory behavior at the expense of attachment behavior, but none seemed to do the reverse. It seems likely that the latter pattern does not emerge until the second year of life, it one is to judge from clinical and anecdotal observations of behavior beyond the first year. Nevertheless, a classificatory system consisting of five groups was formulated on the basis of a "by eyeball" cluster analysis of fourth-quarter behavior, and each baby was classified therein by two or more independent judges. Reliability of classification was satisfactory and any discrepancies among judges were resolved in conference.

Although it is not possible here to describe the classificatory system in any detail, the five groups may be conceived as representing points on a continuum. At the "good" end of the continuum, infants showed due interest in both exploratory and attachment behavior, and the transition between one and the other was smooth. As one proceeded toward the "bad" end of the continuum the transition between exploratory and attachment behavior became difficult, reflecting an increasingly greater mismatch between infant and mother in regard to timing of proximity and contact, with the infant's attachment behavior becoming increasingly more ambivalent. It seemed to be the quality of attachment behavior, and perhaps also the quality of exploratory behavior, and the shift from one to the other that was significant rather than the quantitative balance between them.

Assessment of strange-situation behavior. It may be recalled that the strange situation was devised and used in order to throw light on the use of the mother as a secure base for exploration (i.e., the balance between exploratory and attachment behavior, response to separation and reunion, and response to a stranger by observing infants in an unfamiliar situation.) The situation consisted of eight episodes: an introductory episode, a free-play episode with mother and baby alone, an episode in which a stranger enters and eventually attempts to engage the baby in interactive play, a separation episode in which the baby is left with the stranger, followed by an episode of reunion with the mother. Then followed another separation episode in which the baby was left alone, an episode in which the stranger returned by the mother remained absent, and finally a second episode of reunion with the mother.

The findings relevant to the use of the mother as a secure base will be reported later, as will those relevant to behavior towards the stranger. Here we shall be concerned chiefly with responses to separation and to reunion afterwards. Indeed, it has proved to be responses to reunion rather than responses to separation that emerged as the more significant for individual differences in the organization of infant-mother attachment.

Ainsworth and Wittig (1969) reported a preliminary classification of strange-situation behavior, which was further refined by Ainsworth, Bell, and Stayton (1971). This classification was based chiefly upon infant responses to the mother in the reunion episodes of the strange situation. The differentiations among the various groups and subgroups of the classificatory system suggested that four major dimensions of behavior toward the mother were particularly relevant: (1) proximity- and contact-seeking behavior, (2) contact-maintaining behavior, (3) proximity- and interaction-avoiding behavior, and (4) contact- and interaction-resisting behavior. The three main groups in the strange situation classification can be roughly differentiated as follows. Group A showed conspicuous proximity avoiding in the reunion episodes with relatively little contact maintaining or proximity and contact seeking. Group B showed conspicuous proximity and contact seeking in the reunion episodes with little or no avoiding or resisting behavior. Group C showed conspicuous contact- and interaction resisting behavior in the reunion episodes, with strong proximity seeking and contact maintaining as well--but little or no proximity avoiding. We have advanced the opinion that these classifications reflect significant differences in the quality of the infant-mother attachment relationship.

A variety of analyses are pertinent to our claim that the strange-situation elicits behavior in terms of which an infant can be reliably classified in terms of quality of the attachment relationship: discriminant analyses that support our claim that the classificatory system can be objectively and reliably applied; a factor analysis of strange-situation behavior that provides further evidence that the variables that entered into the classificatory system are relevant to significant behavioral dimensions; a comparison between infants' behavior in the strange situation at the end of the first year and his behavior at home in the last-quarter of the first year (an analysis that is relevant both to the validity of the strange-situation classification and to the stability of infant behaviors pertinent to the attachment relationship); a comparison between infant's behavior in the strange situation and maternal behavior at home; and, finally, analyses that demonstrate significant relationships between strange-situation classification and a variety of other behavioral assessments both much earlier, much later, and contemporaneous with the time at which the strange-situation assessments were made, namely, at the end of the first year.

The findings of the discriminant analyses were reported by Ainsworth (1973b) so a mere summary of the findings will be reported here. The first analysis was undertaken with 55 subjects--23 of the infants in the main project, plus 32 infants from Bell's (1970) study--whose behavior had formed the basis for the classificatory system. The analysis yielded two discriminative functions which provided highly significant discriminations among the three groups, A, B, and C ($p = .00001$; $p = .0048$). The first discriminant function correlated negatively with avoiding the mother in reunion episodes, resisting the stranger in separation episodes and distance interaction with the stranger (characteristic that distinguish Group A from the other two groups), and positively with maintaining contact with the mother in reunion episodes, seeking proximity to her in the second reunion episode, and also resisting contact and interaction with her in the first reunion episode (characteristics of either Group B or Group C or of both that further distinguish them from Group A). The second discriminant function sharply discriminated Group B from Group C. The behavioral variables correlated positively with this function are resistant behavior to the mother in the reunion episodes and resistant behavior to the stranger in the first separation episode (behaviors characteristic of Group C), whereas the chief variable that correlated negatively with this function was seeking proximity to the mother in the second reunion episode (which is characteristic of Group B). Thus the discriminant analysis serves as confirmation of variables highlighted in the classificatory system and of the reliability with which the classification was done.

A more stringent test was to undertake a discriminant analysis for a new sample of 51 subjects. The findings are shown in Figure 1. Again two discriminant functions emerged, which yielded good separation among the three groups, although with less distance between them than did the first discriminant analysis. The correlations that describe the two discriminant functions were similar to those of the first analysis. An even more severe test was to assign the 51 new subjects scores derived from the discriminant functions of the original 55 subjects, and even this yielded a significant discrimination--which is almost never obtained in this kind of analysis.

Insert Figure 1 about here

A discriminant analysis was also undertaken for the total sample of 106 subjects of the classification of Group B subjects into its four component subgroups. This also yielded a highly satisfactory discrimination. Unfortunately the numbers of subjects in Groups A and C were too small to check the discrimination of their component subgroups.

A factor analysis was also undertaken of strange situation behavior based on 33 variables for the full sample of 106 subjects. The variables were as follows: proximity and contact seeking, contact maintaining, proximity and interaction avoiding, contact and interaction resisting, distance interaction and search behavior, as scored for both the mother and the stranger in each of the relevant episodes. The Harmon Minres program with a Varimax rotation was used. One, two, three, and four factor solutions were sought. Of these the three factor solution conveyed the most information.

Table 1

Strange Situation Behaviors with High Loadings on Factor 1

Behavior	Factor Loading
Proximity & contact seeking to mother in Episode 8	.655
Proximity & contact seeking to mother in Episode 5	(.352)
Contact maintaining to mother in Episode 8	.595
Search for mother in Episode 4	(.307)
Proximity & interaction avoiding of mother in Episode 8	-.768
Proximity & interaction avoiding of mother in Episode 5	-.581
Contact & interaction resisting to mother in Episode 8	(-.334)
Distance interaction with stranger in Episode 7	(-.321)

The three factors accounted for 30% of the variance. Table 1 shows the variables with the highest loadings on Factor 1. This first factor is a bipolar factor that contrasts seeking to gain and to maintain proximity and contact with the mother with avoiding proximity and interaction with her in the reunion episodes. In other words, it is concerned with stress-heightened attachment behavior versus stress-activated avoidant behavior toward the mother, the stress obviously having been the separations that preceded the reunions. This factor corresponds to the first discriminant function mentioned earlier, in that it serves to distinguish Group A, the avoidant group, from Groups B and C.

Factor 2 is an interesting one--one that none of our other analyses have suggested, and one that is not represented in the strange-situation classificatory system. (See Table 2.) The definition of Factor 2 is implicit in the variables with high negative loadings, which are nearly all pertinent to the preseparation episodes. It seems reasonable to suppose that a child who especially seeks to gain and to maintain contact with his mother in Episode 2 is wary of the strangeness of the new environment, since most babies during this episode explored the new environment and paid relatively little attention to their mothers. It also seems reasonable that a child who avoids the stranger in Episode 3 and seeks to gain and to maintain contact with his mother is showing some degree of fear or wariness of the unfamiliar person. Although no variable had a high positive loading, the two with the highest loadings further confirm the interpretation that this factor has to do with fear-wariness of the unfamiliar.

Table 2

Strange-Situation Behaviors with High Loadings on Factor 2

Behavior	Factor Loading
Distance interaction with stranger in Episode 3	(.376)
Distance interaction with stranger in Episode 4	(.308)
Contact maintaining to mother in Episode 3	-.864
Contact maintaining to mother in Episode 2	-.416
Proximity & contact seeking to mother in Episode 3	-.628
Proximity & contact seeking to mother in Episode 2	-.601
Proximity & interaction avoiding of stranger in Episode 3	-.733
Proximity & interaction avoiding of stranger in Episode 4	-.565

Like Factor 1, Factor 3 is relevant to the behaviors that entered into the classificatory system. Table 3 shows that at the positive pole

Table 3

Strange-Situation Behaviors with High Loadings on Factor 3

Behavior	Factor Loading
Contact maintaing to mother in Episode 5	.685
Proximity & contact seeking to mother in Episode 5	.554
Contact & interaction resisting to mother in Episode 5	.655
Contact & interaction resisting to mother in Episode 8	(.343)
Contact & interaction resisting to stranger in Episode 4	.629
Contact & interaction resisting to stranger in Episode 7	.470
Contact maintaining to stranger in Episode 4	.490
Contact maintaining to stranger in Episode 7	(.350)
Proximity & contact seeking to stranger in Episode 4	(.333)
Distance interaction with the mother in Episode 5	-.473
Distance interaction with the mother in Episode 8	-.406
Proximity & interaction avoiding of the mother in Episode 5	-.400
Distance interaction with the stranger in Episode 4	-.462
Distance interaction with the stranger in Episode 7	-.456

of this bipolar factor are behaviors that in combination suggest stress-induced ambivalent reactions to both the mother (in the first reunion episode) and to the stranger (in the separation episodes)--the ambivalence being implied by the combination of seeking to gain and to maintain contact with resisting contact and interaction. Behavior of this sort is characteristic of Group C babies. On the other hand, the non-ambivalent heightening of seeking to gain and to maintain proximity and contact, especially in the second reunion episode, is characteristic of Group B babies (especially subgroup B_3) and is loaded on Factor 1. The variables negatively loaded on Factor 3 reflect behaviors characteristic of infants classified in Subgroups B_1 and B_2, namely, distance interaction with the mother in the reunion episodes, rather than conspicuous proximity and contact seeking, mingled with some actual avoidance of her in the first reunion episode. This pattern is associated with relatively much friendliness with the stranger in the separation episodes--although across a distance.

It may be seen that the factor analysis supplements the discriminant analyses in indicating the variables in terms of which individual differences in the organization of the infant-mother relationship may be defined. Furthermore, the emergence of the second, fear-of-the-strange factor, is evidence of the contribution that factor analysis can make to the analysis of complex data. All of our other analyses so emphasized the significance of the quality of the infant's relationship to his mother that they obscured individual differences specific to fear-wariness of the strange and of strangers.

Further multivariate analysis. David Connell of Syracuse University and Saul Rosenberg of the Upstate Medical Center of New York State asked to use our strange-situation data in order to try out further multivariate analysis. They were particularly interested in these data because of the results of our discriminant analyses (reported earlier), and because it is very unusual to encounter classificatory data in which such clear-cut discriminations are implicit. A first draft of their findings is now available to us. It is not possible here to reproduce their highly technical argument in detail. In summary, however, they undertook a "pattern analysis" of 75 variables yielded by our strange-situation technique as measured in 104 subjects, and compared the resulting classification with the classifications of the same subjects as we had originally identified them.

Their analysis proceeded according to the following steps. (1) A preliminary analysis was undertaken to reduce the original set of 75 variables to 42. (2) On the basis of the original 75 variables, however, a "nearest neighbor" evaluation was undertaken. Even on the basis of an unweighted analysis "including numerous irrelevant dimensions" an agreement of 65% was obtained with the original classification--a result considered to indicate extremely high agreement under the circumstances. Nevertheless, this analysis suggested the advisability of including subgroup B_1 as part of Group A, and subgroup B_4 as a part of Group C. (3) The next step was a cluster analysis based on 42 "refined" variables, using the Nonlinear Mapping algorithm described by Sammon (1969). This analysis also suggested that B_1 subjects were associated with Group A and B_4 with Group C. This suggestion was tested by F ratios and discriminant analyses, and confirmed. (4) A pattern analysis was undertaken, containing two basic measurement evaluation algorithms--the "probability of confusion" and the "unimodal discriminant measure"--as outlined by Sammon (1970). This analysis resulted in a set of 13 highly discriminating variables, and in three linear discriminants. The classification matrix for the discriminant technique resulted in a 95.2% agreement with the original Ainsworth classifications.

Connell and Rosenberg concluded that their analysis confirmed the classification system implicit in our technique, with but minor qualifications. They also point out that they have produced a set of discriminant weights which can be applied to measurements derived from our technique, providing an objective method for assigning subjects to the various classes.

Needless to say, I welcomed this entirely objective evaluation of our strange-situation classificatory system, and its encouraging outcome. Nevertheless, this and other earlier-cited findings of multivariate analyses, although demonstrating objectively verifiable individual differences in the organization of social behavior in a laboratory situation, are of little significance if it cannot be demonstrated that different organizations of strange-situation behavior are congruent with individual differences in behavior characteristically manifested in the natural environment of the home.

The home behavior of the strange-situation groups was explored in two main ways: (1) by a comparison of the strange-situation classificatory groups with the groups emerging from the classification of attachment-exploration balance previously mentioned, and (2) by calculating the means of each of the groups for a variety of measures of behavior shown at home in the fourth quarter.

The *attachment-exploration balance* classifications were found to be highly congruent with the strange-situation classifications. The details are complex and since they have been reported by Ainsworth, Bell, and Stayton (1971) they will not be reported in detail here. Suffice it to say that the infants who in the strange-situation showed heightened but unambivalent attachment behavior toward their mothers in the reunion episodes were found at home to have a nice balance between exploratory and attachment behaviors with a smooth transition between them, whereas both those who showed avoidance of the mother and those who showed ambivalence toward her in the reunion episodes of the strange situation demonstrated in their home behavior difficulty in using the mother as a secure base from which to explore and in making a smooth transition from exploratory to attachment behavior.

Ainsworth (1973b) reported the *mean scores for each of the strange-situation groups on each of the fourth-quarter measures of infant behavior at home* that have been so far obtained. Group B was compared with each of Groups A and C, and most of the differences were significant by *t* test. Group B infants more frequently than those of the other two groups greeted the mother positively when she entered the room after an absence, responded positively when they were picked up and held by her, initiated being picked up by her, and complied with her verbal commands. Also more frequently than Group C, but not more than Group A, they responded positively to being put down, and followed the mother when she left the room. The infants of both A and C groups, more frequently than those of Group B, cried when their mothers left the room, and indeed cried more in general. They also more frequently responded negatively to being held, and yet Group A infants also responded negatively to being put down--which smacks of ambivalence. Group C infants, more frequently than Group B babies, cried in greeting the mother when she returned after an absence.

Correlations between home behavior and strange-situation behavior were also calculated. Ainsworth (1973b) reported some of the most noteworthy correlations from a large matrix. Perhaps the most crucial home behavior for "predicting" strange situation behavior was responding positively to being held by the mother. This was positively correlated with seeking proximity and contact in the reunion episodes of the strange situation (.62) and with seeking to maintain contact once contact has been achieved (.52). It was negatively correlated with avoiding the mother in the reunion episodes of the strange situation (-.51) and with a composite score of resistant and avoidant behaviors (-.68). A second notable finding is that neither crying frequency and duration nor frequency of crying when the mother leaves the room at home were significantly correlated with crying in the strange situation. Distress occasioned by separation in an unfamiliar situation is *not* a dependable criterion of the quality of an infant's attachment relationship with his mother. It was the *negative* behaviors in the *reunion* episodes of the strange situation that were most clearly related to attachment behaviors at home. A composite score of avoidant and resistant strange-situation behaviors was positively related to duration of crying at home (.59), frequency of crying at home (.52), and protesting being put down after having been held (.62). It was also related to a resistant behavior at home, namely, responding negatively to being held (.46). It thus seems that anxious and ambivalent behaviors at home "predict" avoidant and resistant behaviors in the strange situation. The composite score of negative strange-situation behaviors was negatively correlated to the following home behaviors: positive response to being held by the mother (-.68), positive responses to being put down by her (-.78), and frequency of initiating being picked up by her (-.45). These findings strongly suggest that an infant's experiences in contact with his mother have an important effect on the degree of anxiety and ambivalence he feels in interaction with her, and the extent to which he uses a primitive, avoidant defense.

Finally, a number of lines of evidence stem from other studies (or other segments of data analysis of the present study) indicating that the differences in the qualitative organization of the infant-mother attachment relationship represented in the strange-situation classificatory groups are "predicted" by mother-infant interaction at home in the first year, and in turn "predict" aspects of infant development of other than infant-mother attachment. These will be mentioned only briefly here, since they will be dealt with more fully in later sections of this report.

(1) *Mother-infant interaction in the feeding situation in the first quarter*. Infants whose mothers' feeding practices were characterized by a relatively high degree of sensitivity to infant signals were classified as Group B in the strange situation at the end of the first year, whereas those whose mothers' practices were relatively insensitive were classified as either Group A or Group C. (Ainsworth and Bell, 1969).

(2) *Mother-infant interaction in face-to-face situations in the first quarter*. As reported earlier (see page 21) infant behavior in face-to-face interaction was compared for three groups, identified in terms of strange-situation classifications at the end of the first year--Subgroup B_3, Subgroups B_1 and B_2 combined, and Groups A and C combined. In nearly all of the comparisons B_1/B_2 were intermediate between the other two groups, so our present report will be concerned only with the comparison between the group that eventually was classified as securely attached (B_3) and that which was eventually classified as insecurely attached (A/C). Babies who later were identified as securely attached, more than those who were later identified as insecurely attached, vocalized to their mothers in face-to-face situations in the first quarter. They also behaved more intensely--e.g., with fuller smiling, and/or some combination of smiling with vocalizing, bouncing, etc.--than did those who later were identified as insecurely attached. Even more striking (as reported on pp. 45-46) was the finding that the potential secure-attached group showed several attachment behaviors differentially to the mother even in the first quarter, whereas the potential insecure-attached group appeared to be non-differential. Furthermore, it was clear that the mothers of the potential secure-attached group differed in their face-to-face behavior from the mothers of other groups (see page 44). The implication is that first-quarter mother-infant interaction in face-to-face situations, like mother-infant interaction in the feeding situation (and presumably mother-infant interaction as a whole), is already influencing the developmental processes that will eventually determine the nature of the attachment relationship--qualitative differences which will be reflected in strange-situation behavior at the end of the first year. (Blehar, Lieberman, and Ainsworth have a paper in preparation reporting the first-quarter face-to-face analysis.)

(3) Infant behaviors and maternal attitudes in respect to physical contact in the fourth quarter. A detailed ethological kind of analysis of infant behavior in respect to physical contact in the fourth quarter yields significant differences between strange-situation groups, and in particular a differentiation between Group A infant and others. Furthermore, inferences from maternal behavior and from interview material strongly suggest that mothers of Group A babies are not only rejecting, but express their rejection through their behavior when in physical contact. The avoidant behavior so characteristic of Group A babies in the strange situation is hypothesized to stem in large part from an approach-avoidance conflict in respect to physical contact with a rejecting mother. (Main and Ainsworth have a paper in preparation reporting this detailed analysis of behavior relevant to physical contact.)

(4) Development of the concept of the object. Bell (1970) found that babies classified as Group B in terms of strange-situation behavior at 49 weeks of age tend in comparison with non-B babies: (a) to be more advanced in the development of the concept of the person as permanent than in the development of the concept of an inanimate object as permanent during the period from 8 to 13 months of age, (b) to be more advanced in person-permanence than non-B babies are in object-permanence throughout this period, and (c) by 13 months to be more advanced than non-B babies even in object permanence (i.e., the concept of the inanimate object as permanent). Thus the organization of the attachment relationship is found to be related significantly to the aspect of cognitive development to which Piaget assigned a leading role in the sensorimotor period. Bell suggested that differences degree of harmony in mother-infant interaction in the course of the first year was primarily responsible for differences in both the development of the object-concept and in the infant-mother attachment relationship.

(5) Exploration, play, and level of cognitive functioning. Main (1973) found that strange-situation behavior at the end of the first year was significantly related to a number of behavioral measures at 21 1/2 and 22 months--measures reflecting various facets of exploration, play, and cognitive functioning. For example, Group B babies, in comparison with non-B babies, had higher DQ's, showed more cooperation and more "game-like spirit" in the intelligence test-situation, showed longer bouts of exploratory behavior in a free play situation, engaged in more interactive play with an adult playmate, emitted less aggressive behavior in the play situation, and less frequently avoided the adult playmate. Furthermore, avoidant and resistant behaviors in the strange situation at 12 months showed different patterns of correlation with measures of exploration, play and cognitive functioning at 21 1/2 and 22 months.

Findings such as these strongly suggest that qualitative differences in mother-infant interaction shape the organization of the infant-mother attachment relationship, and that the nature of this relationship and/or the continuing nature of mother-infant interaction exert influence on a variety of aspects of later development.

Objective 4. Influence of Environmental Variables

Let us discuss the data analysis relevant to this aim under three headings: maternal behavior, the environment mother arranges for the child, and relations to other familiar people.

1. Maternal Behavior

A variety of analyses have traced the relationship between maternal and infant behavior. A relationship has been traced in regard to the following infant behaviors: crying, obedience, behavior in physical contact, responses to leave-room and enter-room situations, behavior in face-to-face interaction, and behavior in the strange situation. In addition, mother-interaction in the feeding situation has been examined.

Infant crying and maternal responsiveness to it. The findings of this analysis have already been reported by Bell and Ainsworth (1972) and will only be summarized here. Three measures of maternal behavior were derived from the coding of infant crying: the percentage of infant crying episodes altogether ignored by the mother, and the length of time in minutes per hour that a baby cried without his mother responding, and her effectiveness in terminating the cry measured by the mean number of interventions she undertook before crying was terminated. In addition the type of intervention used was noted and the effectiveness of each type.

Let us consider the interventions first. The most frequent intervention throughout the first year was to pick the baby up for no other purpose than to institute contact with him. This was also the most effective intervention throughout the first year, although feeding (which occurred much more rarely) was also effective. The least effective intervention was merely to talk with the baby without coming closer to him. (These findings support the concept of crying being a signal that promotes proximity and/or contact.) As might be expected, mothers who were more effective in terminating crying had babies who cried less--but this held only within the time period being examined, i.e., within the quarter year in question. There was no significant correlation between maternal effectiveness in any one quarter and amount of infant crying in subsequent quarters.

The stability of maternal response to crying was examined. Ignoring of crying tended to be a stable maternal characteristic--with mothers who ignored relatively many cries in the first quarter tending significantly to ignore cries in the second and third quarter as well. Duration of maternal unresponsiveness was even more stable, with mothers who were unresponsive in the fourth quarter tending to have been so throughout the whole first year of the baby's life. These findings are in contrast to the findings of infant behavior. The amount an infant cried initially (i.e., in the first quarter) was not significantly correlated with how much he cried later on. Indeed, amount of crying did not tend to become stable until the latter half of the first year.

Within the first quarter there was no significant relationship between either the frequency of infant crying and frequency of maternal ignoring or duration of infant crying and duration of maternal unresponsiveness, but within each of subsequent quarters there was a significant tendency for babies to cry more frequently and longer whose mothers ignored them or delayed in responding to them (Note: a correction for confounded measures was needed and used for these within-quarter comparisons). The most striking finding, however, was that maternal behavior in one quarter was significantly related to infant behavior in the subsequent quarter. Thus mothers who were unresponsive in one quarter had babies who cried more in subsequent quarters. This is taken as evidence that to respond to infant crying makes it less likely to recur in later months, while to ignore it or to delay in responding to it tends to make the infant cry relatively more in later months. Certainly by the end of the first year those babies who cried most frequently and for the longest time were babies whose mothers had been unresponsive to crying throughout the first year. On the other hand, the amount that a baby cried in one quarter did not tend to be related to maternal ignoring or unresponsiveness in subsequent quarters--at least not at the beginning of the first year. There is some evidence, however, that in the second half of the first year babies who cry for relatively long times in one quarter had mothers who are unresponsive in the subsequent quarter, as though a vicious spiral effect were operating.

These findings, together with the findings that maternal unresponsiveness is more stable over time than infant crying, give evidence of direction of effects. Maternal responsiveness-unresponsiveness seems to have more effect on subsequent infant crying than infant crying has on subsequent maternal behavior. (The methodology here is noteworthy. It is a correlational method, in which a measure of infant behavior and one of maternal behavior are made at four successive points in time, and correlated with each other in all possible ways. When experimental control is not possible, this method is a reasonable alternative solution to the problem of sorting out direction of effects in mother-infant interaction--and the Bell-Ainsworth study is the only one so far that has managed to tackle this problem in regard to human behavior.)

Thus it appears that the promptness of maternal response to crying tends over time to reduce the incidence and duration of crying. Promptness appears to be more important than responding with the "right" intervention that will quickly terminate the cry in question.

As reported earlier (page 18) the findings suggested that crying, although entirely expressive at first, tended to become a mode of communication by the fourth quarter. This prompted an assessment of non-crying modes of communication--facial expression, gesture, and vocalization. It was found that those babies who had the most varied, clear, and subtle modes of non-crying communication had mothers who responded relatively promptly to crying signals. Furthermore, mothers who were promptly responsive to crying were relatively sensitive to infant signals and communications of all kinds. Therefore, the rounded picture of the influence of maternal behavior suggests that a mother who is responsive to infant signalling behaviors, including crying, helps her baby to communicate in ways other than crying rather than merely reducing the amount the baby cries.

Infant separation protest, following and greeting as related to maternal behavior. Since Stayton and Ainsworth (1972) have reported on these, only a summary will be given here. None of these infant behaviors (fourth-quarter measures) were related significantly to the two measures of maternal behavior pertinent to leave- and enter-room situations, namely, frequency of leaving the room, or frequency of acknowledgement of the baby upon entering the room. Six other measures of maternal behavior were examined, however, four stemming from the rating scales mentioned on page 14, and two from the analysis of crying.

Crying when mother leaves the room was positively and significantly correlated with maternal ignoring of crying (.45) and duration of maternal unresponsiveness to crying (.46), and negatively related to infant signals and communications (-.40). Following the mother when she leaves was positively correlated with maternal accessibility (.48) and with her sensitivity to signals (.40). Positive greeting to the mother when she enters the room was positively related to maternal acceptance (.50), cooperation (.49), and sensitivity (.46), and negatively related to maternal ignoring (-.42) and delay in responding to crying (-.40). Although crying and mixed responses to mother's entrance were not significantly correlated with any of the maternal variables, the direction of the correlations is identical with those for crying when mother leaves the room, and in each case opposite to positive greeting. To highlight the most important findings, a mother who is insensitive to her baby's signals in general and who is unresponsive to his crying in particular is likely to have a baby who more frequently than others protests her departures in the familiar environment of the home (not, however, in the strange situation), whereas a mother who is sensitive to signals, cooperative, accessible, and accepting (as the mothers of all our securely attached babies were) is likely to have a baby who follows when she leaves rather than protesting her departure, and who greets her cheerfully when she returns from a brief absence.

Infant obedience and maternal behavior. Stayton, Hogan, and Ainsworth (1971) reported on this topic; their findings will be summarized here. The infant measures in this study were: compliance to maternal verbal commands, "internalized controls" (indicated by instances in which a baby inhibited himself from carrying through a previously prohibited activity), IQ (as measured by the Griffiths scale), and sex. The maternal measures were: frequency of verbal commands issued, frequency of physical intervention (in lieu of or to follow up verbal commands), the extent to which the mother allowed the baby floor freedom, and behavior as rated on three of the fourth-quarter scales--sensitivity-insensitivity, cooperation-interference, and acceptance-rejection. The analysis of the data proceeded in three steps: a matrix of intercorrelations, a step-wise regression analysis with infant compliance as the criterion measure, and a principal-components analysis.

To summarize, the findings were that sensitive, accepting, cooperative mothers tend to have babies who obey their verbal commands. Maternal emphasis on discipline as reflected by the frequency of verbal commands was essentially uncorrelated with infant obedience, and the frequency of physical interventions was negatively related to obedience. The development of internalized controls seemed also to be related to maternal sensitivity, acceptance, and cooperation, but degree of floor freedom allowed and IQ also played a part in this development. In short, infants who have had harmonious interaction with their mothers tend to be predisposed to comply with their wishes and to build up a basis of internal control, whereas infants who have had relatively disharmonious interaction, and especially those whose mothers attempt to instil discipline by forceful reinforcement of commands, tend to be relatively disobedient.

The relationship between maternal and infant behaviors in physical contact. Before considering the relationship between maternal and infant behaviors it is first necessary to consider the "normative" changes in maternal physical-contact behavior throughout the first year and also its stability.

The total amount of holding decreases progressively from 20 minutes per hour in the first quarter to less than 6 minutes per hour in the fourth. The mean duration of a pick-up episode shows a similar decline. On the other hand, the frequency of pick-up episodes remains essentially constant thoughout the first-year--about three per hour. In the first quarter 69% of pick-up episodes were for routine purposes--feeding, diapering, transport, etc.--whereas in the fourth quarter 79% were for non-routine purposes. The proportion of pick-up episodes in which the mother demonstrated affection to the baby remained fairly stable throughout the first year, ranging from 12% to 18%. The proportion of pick-up episodes in which the mother played or interacted with the baby peaked in the second quarter (19%), but accounted for only 10% of pick-up episodes in the fourth quarter when interactive play was more likely to occur when infant and mother were not in physical contact. The proportion of pick-ups that constituted interference with the baby's autonomous activity was very small in the third quarter (3%)--and indeed was impossible to assess before then--but increased to 13% in the fourth quarter. The proportion of holding time characterized by tender, careful maternal behavior was relatively large in the first quarter (33%) but declined gradually until the fourth quarter when it was 14%. The proportion of holding time characterized by inept, inappropriate maternal behavior also declined--from 19% in the first quarter to 8% in the fourth. Indeed, as the baby grew older not only did it become more difficult to distinguish careful or inept holding from ordinary holding, but also these qualitative distinctions seemed to be less pertinent.

The stability of maternal behaviors throughout the first year was also examined. One of the most stable of the measures was the percentage of pick-up episodes in which affection was demonstrated. (See Table 4.) There was a significant tendency for mothers who showed relatively much affection in the first quarter to continue to do so throughout the rest of the first year.

Table 4

Stability of Percentage of Maternal Pick-ups in which Affection was Expressed

	First Quarter	Second Quarter	Third Quarter	Fourth Quarter
First quarter	...			
Second quarter	.40*	...		
Third quarter	.57**	.63**	...	
Fourth quarter	.63**	.34	.62**	...

The proportion of time spent in tender, careful holding showed a fair degree of stability, although this behavior was so infrequent in the fourth quarter that the correlations of earlier quarter with the fourth quarter tended to be negligible. The proportion of pick-up episodes in which the mother played with her baby showed a substantial correlation (.61) between second and third quarter behavior, but other correlations were low, presumably because play while in contact was so infrequent in both first and fourth quarters. The proportion of time spent in inept, inappropriate holding was impressively stable throughout the first three quarters, although the correlations of fourth-quarter behavior with earlier behaviors were marginally significant.

Three quantitative aspects of holding also tended to show substantial stability. For example, all coefficients of correlation in the matrix for frequency of pick-up episodes per hour ranged between .51 and .67. Total holding time and mean duration of a pick-up episode also showed substantial stability.

In general, maternal behavior tended to show more stability from the first quarter onwards (at least until and including the third quarter) than did infant behavior, which tended not to become stabilized until the second quarter. This is one line of evidence that maternal behavior is a more potent influence on the response of the infant to physical contact than infant behavior is on maternal behavior.

The interrelationships among the various measures of maternal behavior are also of interest. The matrix of first-quarter behaviors was discussed by Ainsworth, Bell, and Stayton (1972). The matrix for second-quarter behaviors is shown here in Table 5.

Table 5

Intercorrelations of Maternal Physical-Contact Behaviors in the Second Quarter

	1	2	3	4	5	6	7
1. Total holding time	...						
2. Mean duration of pick-up	.60**	...					
3. % Affectionate pick-ups	.02	.24	...				
4. % Play pick-ups	-.06	.44*	.42*	...			
5. Number of pick-ups per hour	.36	-.42*	-.18	-.47*	...		
6. % tender, careful holding time	.03	.41*	.48*	.65**	-.37	...	
7. % inept holding time	-.21	-.32	-.31	-.50*	.04	-.64**	...

It may be seen that the total time spent in physical contact with the baby was not significantly related to the qualitative aspects of holding. On the other hand the length of a pick-up episode was positively related to the proportion of time spent in tender, careful holding and to the proportion of pick-ups characterized by playful interaction. Conversely, the frequency of pick-ups tended to be negatively related to these variables, while there was also a negative relationship between frequency of pick-ups and their duration. The various measures of positive quality of pick-ups (i.e., affectionate, playful, and tender and careful) are positively and significantly related to inept holding.

The matrix for the third quarter shows essentially the same interrelationships, and will not be given here. The matrix for the fourth quarter is also similar, except that the mean duration of a non-routine pick-up emerged as significantly related to a number of other maternal measures--positively related not only to total holding time and the mean duration of a pick-up (as might be expected) but also to affectionate pick-ups, and negatively related not only to frequency of pick-ups but also to interfering pick-ups.

Now let us consider the relationships between maternal and infant behavior. Within the first quarter it is clear that babies who were held tenderly and carefully tended to respond positively to being held (.43) and also positively to being put down (.39), while those who were not held tenderly and carefully tended to respond negatively to being put down (-.57). How much--how long or how frequently--the baby was held did not seem to influence his responses to being picked up or put down. On the other hand, during this first quarter, maternal ineptness in holding did not seem to produce a negative response to physical contact as though the baby was so predisposed toward accepting physical contact that he did not consistently respond negatively even when holding was of poor quality.

Within the second quarter, however, maternal behavior seems to have more impact on infant behavior. (See Table 6.) Again, it is the qualitative aspects of maternal behavior that seem to have the most influence. Babies who responded negatively to being held tended to have mothers who held them ineptly, rather than tenderly and carefully. Tender, affectionate, and/or playful maternal holding behavior was positively related to acceptance of

Table 6

Intercorrelations of Maternal and Infant Physical-Contact within the Second Quarter

	Infant Behaviors			
Maternal Behaviors	Positive to hold	Negative to hold	Positive to put-down	Negative to put-down
Total holding time	.18	-.05	.10	.22
Mean duration of pick-up	.36	-.09	.43*	-.49*
Number of pick-ups/hour	-.19	00	-.30	.41*
% Tender, careful holding	.65**	-.57**	.81**	-.36
% Affectionate pick-ups	.41*	-.25	.57**	-.35
% Playful pick-ups	.46*	-.39*	.54**	-.27
% Inept holding	-.57**	.74**	-.57**	.27

being put down, as indeed was a relatively long duration of a pick-up episode. It would seem that a well-rounded, pleasant episode of holding leaves the baby content to be put down. On the other hand, babies who were frequently picked up but held briefly tended to be the ones who protest being put down. On the other hand the total amount of holding time (as distinct from its "pacing") did not seem to influence a baby's response to physical contact or its cessation. Nor did the quantitative aspects of holding seem to influence whether a baby responded positively or negatively to the holding itself.

Very much the same picture was yielded by the within-quarter matrices for the third and fourth quarter, and therefore details will not be discussed here.

So far we have talked as though it is maternal behavior that affects infant behavior, but, as was pointed out in our discussion of infant crying and maternal responsiveness to it, within-quarter correlations between maternal and infant behavior do not properly permit one to infer direction of effects. For this it is necessary to examine cross-quarter correlations between infant and maternal behavior. This task is very much more complex in regard to physical contact behavior than it was for crying behavior, if only because there are so many more behavioral measures to be considered. Within the span of this report it is possible to consider only a few combinations of maternal and infant behavior.

Let us consider first the relationship between maternal holding of tender, careful quality and infants' positive response to being held. Table 7 shows the cross-quarter correlation matrix. It is evident that tender maternal holding behavior in any one quarter was substantially and positively correlated with positive infant response to holding in all subsequent quarters. On the other hand, positive infant behavior in any one quarter was not significantly correlated with subsequent maternal behavior (except for the coefficient of .41 between second-quarter infant behavior and third-quarter maternal behavior). It certainly appears that maternal behavior of a tender, careful quality has more influence on subsequent infant behavior than a positive infant response to holding has on subsequent maternal behavior.

Table 7

Intercorrelations between Tender, Careful Maternal Holding Behavior and Infants' Positive Response to being Held

Proportion of holding time in which mother is tender and careful	Infant positive response to holding			
	1st quarter	2nd quarter	3rd quarter	4th quarter
First quarter	.43*	.51**	.53**	.46**
Second quarter	.28	.65**	.69**	.67**
Third quarter	.38	.41*	.40*	.44*
Fourth quarter	.26	.25	.25	.12

A fairly similar picture was yielded by the intercorrelations between the percentage of pick-up episodes in which a mother plays with her baby and an infant's positive response to being held. In interpreting this matrix, it must be kept in mind that maternal play behavior is relatively infrequent in the first and fourth quarters. It may be seen from Table 8 that maternal play behavior in both the second and third quarters was significantly associated with infant's positive response to being held in subsequent quarters, whereas there was no similar tendency for infants' positive response to being held to be associated with frequency of maternal play in subsequent quarters (except for one significant correlation between second-quarter infant behavior and third-quarter maternal behavior).

Table 8

Intercorrelations between Percentage of Pick-up Episodes in which Mother Play with Infant and Infant's Positive Response to Being Held

Percentage of pick-up episodes in which mother plays with infant	Infant positive response to holding			
	1st quarter	2nd quarter	3rd quarter	4th quarter
First quarter	-.02	-.11	.11	.20
Second quarter	-.06	.46*	.52**	.63**
Third quarter	-.05	.52**	.46*	.58**
Fourth quarter	-.26	.29	.26	.47*

Maternal affectionate behavior in pick-up situations, on the other hand, seems to be influenced by infants' positive response to being held, as shown in Table 9. To be sure infant behavior in the first quarter did not seem to influence maternal behavior significantly, but positive infant behavior in the second and third quarters was positively correlated with maternal

Table 9

Intercorrelations between Percentage of Pick-up Episodes in which Mother shows Affection and Infants' Positive Response to Being Held

Percentage of pick-up episodes in which mother shows affection	Infant positive response to holding			
	1st quarter	2nd quarter	3rd quarter	4th quarter
First quarter	.19	.13	.19	.22
Second quarter	.32	.41*	.33	.36
Third quarter	.36	.49*	.43*	.44*
Fourth quarter	.28	.41*	.51**	.46*

display of affection in subsequent quarters, whereas the reverse tendency was not as strong.

Let us present one more matrix, that between the proportion of maternal holding time characterized by inept and inappropriate behavior and infants' negative response to being held. Table 10 suggests that inept holding is associated with negative infant response in subsequent quarters, but also that in the second and third quarters, a negative response to holding on the part of an infant is associated with inept maternal behavior in subsequent quarters. The magnitude of the correlations, especially in the second and third quarters suggests a very strong interaction between maternal and infant behaviors. Nevertheless, since first-quarter infant behavior is not significantly associated with subsequent maternal behavior, whereas first-quarter maternal behavior is significantly associated with subsequent infant behavior, it would seem that maternal behavior has more potent influence on infant behavior than vice versa.

Table 10

Intercorrelations between Inept, Inappropriate Maternal Holding Behavior and Infants' Negative Response to Being Held

Proportion of holding time in which mother is inept or inappropriate	Infant negative response to holding 1st quarter	 2nd quarter	 3rd quarter	 4th quarter
First quarter	.05	.42*	.56**	.24
Second quarter	.11	.74**	.73**	.35
Third quarter	.22	.80**	.78**	.47*
Fourth quarter	.24	.48*	.53**	.23

In summary, there is no convincing evidence that constitutional differences in infant cuddliness determine either subsequent infant response to physical contact or maternal pick-up and holding behavior. On the contrary, there is substantial evidence that maternal behavior in the early months influences subsequent infant response to physical contact, although there is also some evidence that vicious and virtuous spirals may be set up, in that infant behavior, influenced by maternal behavior in previous quarters, may in turn influence maternal behavior in subsequent quarters. (In these interrelationships between maternal and infant behavior it is the qualitative aspects of maternal behavior that seem more important in influencing infant behavior than the quantitative aspects.) Blehar, Bell, and Ainsworth intend to prepare a monograph reporting both the developmental trends in physical contact behavior and the findings of this intercorrelational analysis of infant and maternal behavior.

Main and Ainsworth will publish a supplementary paper based on a very detailed and intensive analysis of infant behavior relevant to physical contact in the fourth quarter and its relationship to strange-situation classifications at the end of the first year. The analysis is too detailed to be reported here, but the gist of the findings may be summarized as follows.

In the fourth quarter Group A babies--those who show defensive avoidant behavior toward their mothers in the reunion episodes of the strange situation--seek contact with their mothers in the home environment as frequently as do Group B and C babies. But their initiations of physical contact are tentative and/or incomplete. Thus they touch the mother, but do not clamber up on her, and they tend to touch the mother's foot rather than any less peripheral part. The active contact behaviors shown on occasion by Group B infants are almost entirely lacking in the Group A babies. Group A mothers may be distinguished from Group B and C mothers by rejecting attitudes toward the baby (Ainsworth, Bell, and Stayton, 1971). There is evidence that these rejecting attitudes express themselves to the baby largely through physical contact behaviors--i.e., inept rather than tender, careful holding, interfering pick-ups rather than pick-ups for affection, and the like. It is as though the baby, having had unpleasant experiences when in physical contact, develops an approach-avoidance conflict relevant to it. Like other babies, he seeks proximity and contact, but unlike other babies he also tends to avoid it because of his negative experiences when in contact. Consequently, when he approaches he touches his mother tentatively, perhaps only her foot, and then moves away again.

Mother-infant interaction in face-to-face situations. So far the analysis of mother-infant interactions in face-to-face encounters has been completed only for the first quarter, and a paper reporting the findings is currently being prepared by Blehar, Lieberman, and Ainsworth. Analysis of similar interactions in the second and third quarters is also nearing completion, and will be reported in a book by Ainsworth, Tracy, and Blehar.

The first-quarter analysis compared strange-situation groups in regard to both maternal and infant face-to-face behavior. In this analysis subgroup B_3 (the "normative" secure-attached group) was compared with Groups A and C, and with an intermediate group constituted by infant classified as B_1 and B_2.

In initiating face-to-face interaction Group A/C mothers tended more frequently than B_3 mothers merely to bend over the baby rather than vocalizing or smiling to him ($p < .05$). In responding to infant initiative in face-to-face- interaction Group B_3 mothers tended to vocalize more frequently than did A/C mothers ($p < .10$), whereas A/C mothers more frequently did not respond at all to infant initiative ($p < .05$). Group B_3 mothers very much more frequently than A/C mothers were sensitively responsive to infant behavior in their pacing of interaction ($p < .001$), and in persisting long enough in their initiations of interaction to permit the baby time enough to mobilize a response ($p < .005$). Group A/C mothers tended more frequently than B_3 mothers to be inept and/or abrupt ($p < .001$) in their face-to-face behavior. B_3 dyads more frequently than A/C dyads engaged in prolonged face-to-face encounters ($p < .025$) in which there was continued reciprocal interplay ($p < .005$). A/C dyads more frequently than B_3 dyads had brief face-to-face encounters ($p < .005$). (In nearly all of these comparisons B_1/B_2 mothers were intermediate between B_3 and A/C mothers.)

The infant groups did not differ in regard to state prior to face-to-face encounters; the great majority of the babies were content. B_3 babies were significantly more likely than A/C infants to initiate interaction with their mothers ($p < .05$). They did so through vocalization significantly more often than A/C infants ($p < .01$), but not significantly more frequently through smiling. In response to their mother's initiations of interaction B_3 infants significantly more than A/C infants smiled ($p < .025$), and bounced or jiggled ($p < .001$) A/C infants more frequently than B3 babies fussed ($p < .025$). B3 babies responded more intensely to mother's initiations than A/C babies ($p < .001$). They displayed positive affect more frequently not only during face-to-face encounters ($p < .005$), but also after the encounter was over ($p < .01$). A/C infants more frequently than B_3 infants terminated the face-to-face interaction, usually by averting the gaze ($p < .005$). (In nearly all of these comparisons B_1/B_2 babies were intermediate between B_3 and A/C babies.)

The remarkable thing about these findings is that differences in the quality of the attachment relationship that are evident in the strange-situation at the end of the first year are foreshadowed by significant differences in the quality of both maternal and infant behavior in face-to-face interaction during the first three months of life. We are inclined to attribute causal significance to maternal behavior in these early months as influencing not only interaction at that time but also the eventual quality of the attachment relationship, but we acknowledge that this inference is not justified solely on the basis of the findings of the first-quarter face-to-face analysis.

Perhaps even more interesting than these findings are those that compare the behavior of the infant toward the mother versus a stranger in face-to-face encounters in the first quarter. Table 11 shows these findings.

Table 11

Infant Behavior in Face-to-face Encounters with Mother and Stranger in the First Quarter

Infant response to adult in face-to-face encounter	Strange-Situation Groups								
	B_3			A/C			B_1/B_2		
	to M	to S	p	to M	to S	p	to M	to S	p^*
Smile	45.0	28.5	.11	29.5	28.5	ns	39.9	48.3	
Vocalize	29.4	13.8	$<.05$	8.2	19.9	ns	20.3	28.5	
Bounce, jiggle	21.3	6.0	$<.05$	5.4	5.0	ns	9.7	1.3	
Negative, fuss	2.8	2.2	ns	9.6	2.1	$<.025$	1.7	1.3	
No response	4.6	12.6	ns	13.8	21.4	ns	3.7	22.0	
Positive affect during F/F	60.5	37.9	$<.01$	30.6	37.1	ns	35.4	23.8	
Intensity of response	3.7	2.5	$<.01$	2.0	1.9	ns	2.6	2.6	
B terminates F/F	11.8	31.7	$<.01$	26.9	22.5	ns	11.6	45.0	

*p's for comparison of the B_1/B_2 group with other groups have not yet been calculated.

Except for intensity of response, which is a composite score based on the number of variable entering into the response, all measures are of percentage of face-to-face encounters in which a behavior occurs.

It may be seen that B_3 infants respond differentially to mother and stranger even in the first three months of life. They are significantly more likely to bounce, jiggle, and vocalize in face-to-face encounters with the mother and tend to smile more frequently; they respond more intensely and with more positive affect, and are less likely to terminate the face-to-face encounter. A/C infants do not behave differentially to mother in comparison with a stranger in face-to-face encounters, except that they are more likely to respond negatively to the mother. B_1/B_2 infants are clearly an intermediate group. (Significance levels of differences of behavior toward mother and stranger have not yet been calculated for them. Perhaps no differences will prove to be significant, since the group is very small.)

Discrimination of an attachment figure from other figures is hypothesized to be a necessary condition for the development of an attachment relationship. The present findings would suggest therefore that the development of attachment is facilitated by the kind of interaction with their mothers experienced by one group of infants (those who are later classified as B_3) but not by the kind of interaction experienced by another group of infants (those later classified as A or C) in that the former show differential attachment behavior toward the mother in distinction from a stranger even during the first quarter whereas the latter tend not to do so.

Relationship between infant strange-situation classification and maternal behavior at home. Ainsworth, Bell, and Stayton (1971) reported on differences among mothers of infants in different strange-situation groups and subgroups in regard to their ratings on four scales measuring maternal behavior in the infants' fourth quarter. These ratings showed sharp differences among groups and subgroups. Indeed, each subgroup (except that B_1 and B_2 were lumped together) was associated with a unique combination of maternal scores. Thus mothers of B_3 babies were clearly sensitive, accepting, cooperative, and accessible, while B_1/B_2 were mid-scale in all of these characteristics. All mothers of A and C babies were clearly insensitive to infant signals and communications. Mothers of Group A babies were all clearly rejecting; mothers of A_1 babies were also interfering, whereas mothers of A_2 babies were ignoring but not interfering. Mothers of Group C babies were mid-scale on acceptance-rejection, but C_1 mothers were interfering while C_2 mothers were ignoring.

Table 12 shows the mean scores of mothers of babies in various strange-situation groups on further measures of maternal behavior at home in the fourth quarter, these measures being derived from various coding analyses. Here we have distinguished Subgroup B_3, Subgroups B_1/B_2, Group A, and Group C. The differences between the means have not yet been tested for significance. Direction of trends will therefore be featured in this report.

In 8 of the 14 measures of maternal behavior there is a progression (increase or decrease) from B_3, to B_1/B_2, to A and/or C. Those that increase progressively are: number of baby's crying episodes per hour that the mother ignores, duration of mother's unresponsiveness to baby's crying, frequency of mother's physical interventions to reinforce or substitute for verbal commands, percentage of holding time devoted to routines, percentage of holding time in which holding in inept, and percentage of pick-ups that are abrupt or interfering. Those that decrease progressively are: percentage of pick-ups in which there is affectionate interaction and percentage of pick-ups in response to the baby's signals or initiations. Thus mothers of B_3 babies (and to a lesser extent mothers of B_1/B_2 babies) were responsive to infant signals, affectionate in physical contact, and respectful of the baby's autonomy in that they did not unduly interfere with his activity in progress. In contrast, the mothers of A and C babies were unresponsive to infant signals, interfering and abrupt, inept in physical contact, and tended to hold chiefly for routines and very little for affectionate exchange.

Table 12

Mean Scores of Mothers of Babies in Different Strange-Situation Groups on Measures of Maternal Behavior at Home

Maternal Behavior	Mothers of B_3 babies	 B_1/B_2 babies	 A babies	 C babies
Ignoring of crying (eps./hr.)	1.17	1.60	2.06	2.88
Unresponsiveness to crying (duration)	1.06	1.76	3.24	4.44
Freq. of leave-room eps. per hour	3.40	3.10	3.73	3.57
Freq. of acknowledgement of B on E/R	34%	36%	18%	23%
Freq. verbal commands	1.90	4.05	2.37	2.71
Freq. physical interventions	.48	.80	1.31	1.77
Floor freedom permitted	1.67	1.50	1.50	1.67
Mean duration of non-routine pick-up	3.06	2.33	1.50	2.00
Routine holding (% of holding time)	15.67%	21.25%	21.33%	46.25%
Inept holding (% of holding time)	2.33%	7.55%	9.83%	15.00%
% Affectionate pick-ups	25.56%	20.50%	8.93%	4.00%
% Abrupt, interfering pick-ups	6.11%	15.75%	20.38%	14.25%
% Pick-ups for play interaction	10.87%	10.00%	5.67%	12.75%
% Pick-ups to B's P/U appeal	24.22%	17.25%	16.17%	9.50%

Group C mothers, however, relatively frequently played with the baby while holding him, whereas Group A mothers rarely did so. A and C mothers less frequently than B mothers acknowledged their babies upon entering the room. B_3 mothers had the longest duration of a non-routine pick-up, and A mothers the lowest.

The other variables in Table 12 (frequency of leaving the room, frequency of verbal commands, and extent of floor freedom permitted) show no clear inter-group trends. In summary, these analyses strongly suggest that babies classified in different strange-situation subgroups have experienced different kinds of mother-infant interaction at home in the fourth quarter, that B_3

babies have had harmonious experiences, whereas Group A and perhaps especially Group C infants have experienced disharmonious interaction.

Relationship between maternal behavior relevant to feeding and infant behavior. One of the first data analyses completed (Ainsworth and Bell, 1969) dealt with patterns of maternal practices relevant to feeding and (a) other maternal behaviors tapped by a selection of first-quarter rating scales, (b) infant crying behavior in the first quarter, and (c) infant strange-situation classification at the end of the first year.

The various patterns of feeding behavior were ordered roughly in terms of the extent to which maternal responsiveness to infant signals permitted the baby to be an active participant in the feeding interaction. It was clear that the more responsive feeding patterns were related to being able to see things from the baby's point of view, delight in and acceptance of the baby, appropriateness of interaction, amount of physical contact, and effectiveness of mother's response to infant crying, whereas the less responsive feeding patterns were related to low scores on these variables. This suggested that a mother's feeding practices reflected the general tenor of her attitude toward and interaction with her baby.

The more sensitively responsive maternal feeding practices were associated with relatively brief and infrequent crying in the first quarter, whereas the less sensitive practices were associated with more crying, the pattern of the crying varying with the type of practice. Finally, babies classified as B_3 (i.e., as securely attached) in terms of strange-situation behavior at the end of the first year had experienced relatively sensitive feeding interaction in the first-quarter, whereas babies classified as A and C had experienced relatively insensitive feeding interaction--with no overlap between the B_3 and A/C groups. B_1/B_2 babies were distributed, half in the relatively sensitive and half in the relatively insensitive groups in regard to feeding to feeding practices.

Ainsworth and Tracy (1973) reported further analysis of the relationship between maternal and infant behavior in respect to feeding, especially comparing first-quarter with fourth-quarter behavior. In this analysis they used the four first-quarter rating scales concerned with feeding that had been derived from the pattern analysis of first-quarter feeding interaction reported by Ainsworth and Bell (1969). Mothers who were rated low for responsiveness to infant signals (mean scores on the four rating scales) had babies whose first-quarter feedings had been described by Ainsworth and Bell as unhappy ($r_{pbi} = .61$; $p < .005$) and who also spit up a lot ($r_{pbi} = .46$; $p < .02$).

An analysis of fourth-quarter feeding interaction yielded no dimensions of maternal behavior that seemed significantly related to infant behavior. It seemed that infant behavior was more closely related to general characteristics of maternal behavior than to specific fourth-quarter feeding practices. Thus maternal sensitivity-insensitivity to infant signals (assessed by a fourth-quarter rating scale mentioned earlier) was positively related to the degree of infant happiness-unhappiness in feeding as assessed on a 7-point scale ($r = .83$; $p < .001$).

Even more striking were the relationships between maternal feeding practices in the first quarter and infant feeding and other "oral" behavior in the fourth quarter. Maternal sensitivity to feeding signals in the first quarter (the mean of the four first-quarter scales relevant to feeding) was strongly related to happiness-unhappiness in the baby's fourth-quarter feedings ($r = .68$; $p < .001$). Furthermore maternal behavior in the first quarter was significantly related to persistent spitting up in the fourth quarter ($r_{pbi} = -.57$; $p < .01$) and to frequent fourth-quarter thumb-sucking ($r_{pbi} = -.50$; $p < .01$). It is not clear from this analysis alone whether early maternal feeding practices have a specific effect on later infant affect in feeding and on later "oral" problem behavior, or whether early maternal feeding practices are merely representative of general maternal attitudes and behaviors that are fairly stable throughout the first year and it is the cumulative effect of the whole constellation that influences fourth-quarter feeding affect and oral behaviors. In either case it is striking that the measures developed in the present project demonstrate significant intercorrelations between maternal and infant behavior, whereas earlier studies of the effects of maternal feeding practices (see Caldwell, 1964) yielded findings that were essentially negative or equivocal.

Our findings raise important theoretical considerations about the role of feeding interaction in the development and organization of attachment. These have been discussed by Ainsworth and Bell (1969), Ainsworth and Tracy (1973), and Ainsworth (in press, a), but deserve further consideration in the light of analysis of feeding practices and interaction throughout the whole of the first year--an analysis that has not yet been completed.

2. The Environment that Mother Arranges for the Child

Here two projects are relevant. The first is a study undertaken by Dr. Mary Blehar, as her doctoral dissertation research, on the influence of day care on a young child's attachment relationship to his mother. The second is an analysis of environmental variables that might be hypothesized to be associated with infant sensorimotor development in the first year.

Effect of day care versus home rearing. Dr. Blehar's study (in press) was an offshoot of the main project, and hence is reported here. She used the strange situation as a basis for assessing qualitative differences in the child-mother attachment relationship. She studied two groups of children in full-time day care, one group 30 months old at the time of assessment, and the other group 40 months old. Each group had been in day care for approximately five months, and thus one group had started day care at approximately two years of age and the other at approximately three years of age. She compared them with two groups of home-reared children equivalent to the day-care children in age at the time of assessment. The sample consisted of 40 children, 10 in each of four groups, with equal numbers of boys and girls in each. An ANOVA design was used, which could examine rearing effects, age effects, sex effects, and strange-situation episode effects, as well as the dinteractions among them.

All children were from middle-class families. Neither the Caldwell Inventory of Home Stimulation (1970) no the use with the mothers of Hogan's Empathy Q-sort (1969) yielded differences between day-care and home-reared groups. The groups were equivalent also in mother's level of education and other demographic variables. The day care centers were good "middle-class" centers with a traditional nursery-school type of "curriculum." The centers were open from 7:30 a.m. to 5:30 p.m., and the children attended from 8 to 10 hours per day, five days a week.

Striking qualitative differences in the child-mother attachment relationship between day-care and home-reared groups could be inferred from differences in strange-situation behavior. The day-care children were significantly more anxious in their attachment to their mothers. They were more distressed by the brief separations implicit in the strange-situation procedure, and showed more avoidant and resistant behavior to their mothers in the reunion episodes--behaviors that we have found (Ainsworth, 1973) to be characteristic of one-year-olds whose home behavior showed them to be anxious and insecure. Furthermore, they showed less distance interaction with their mothers than did the home-reared children.

Even more striking was the evidence that age of beginning day care was important in determining the way in which the attachment relationship was affected. The 40-month-old day-care group (those who began day care at three) was overtly the most anxious group. More than any other group they cried in the strange situation and showed heightened proximity-seeking behavior in the reunion episodes. Although they avoided their mothers in the reunion episodes, this was mingled with angry, resistant behavior. The whole picture was one of anxiously heightened, ambivalent attachment behavior. They behaved as children who had been sensitized to separation, rather than as children whose long daily separations in day care had inured them to it. In contrast, the 30-month-old day care group (those who had begun day care at two) behaved quite differently. They cried no more than the home reared groups. They showed less proximity-seeking behavior in the reunion episodes than any of the groups, and much greater avoidance of the mother.

In short, the 40-month-old day care group behaved much like Group C babies in the strange-situation, whereas the 30-month-old group behaved like Group A babies. The apparent lack of disturbance shown by the 30-month-old group--the seeming "independence"--is ominous, for it appears to be founded on an avoidant, defensive reaction essentially like that shown by babies whose mothers have been especially rejecting and insensitive throughout the first year.

Furthermore, it might have been assumed that one bonus day-care children would have received as a result of their experiences would be a feeling of ease with strangers. Not so. The day-care groups significantly more than the home-reared groups avoided the stranger in the strange situation.

It would have been good had Dr. Blehar been able to include in her study observations of the initial responses of her subjects to day care. Mrs. Sally Wall--another Ph.D. student working under my supervision--has begun a dissertation research focusing on these responses. It was Dr. Blehar's hypothesis that the disturbance she attributed to day care was due to the long daily separations implicit in full-time day care. Mrs. Wall is testing this hypothesis by comparing the responses of children entering day care with the responses of children entering nursery school, in which the daily separation does not exceed four hours. There are two age groups in each of the main groups--three-year-olds and four-year-olds. The responses in which she is most interested are responses to separation in the morning when the mother leaves and responses to reunion later when she returns. She is interested also in how these change over time. Her data are three-fourths collected at this time.

Environmental variables relevant to sensorimotor development. During the last three semesters Dr. Blehar has supervised undergraduate research assistants (volunteers) in an analysis of the narrative reports of visits during the fourth quarter to all the babies in the main sample, in an attempt to assess the kind and degree of stimulation and encouragement the environment (including the mother herself) provides toward sensorimotor development. The analysis has been divided into three main parts: locomotor achievement, manipulatory skills, and vocalization.

The research assistant concerned with locomotor achievement assembles evidence from the narrative reports of the following: general outline of locomotor activity, episodes in which mother encourages locomotor achievement, quality of mother-infant interaction in regard to the encouragement or discouragement of locomotor activity, amount of floor freedom permitted, maternal reinforcement of locomotor achievement, amount of crawling, amount of walking, and maternal teaching and prompting. After this evidence has been assembled it is intended to derive measures of various aspects of maternal behavior and maternally-arranged environment that seem likely to be specifically relevant to locomotor development. Finally, the relationship of these to the Griffiths' Locomotor Scale and to sensorimotor development in general (as measured by the Griffiths' General Quotient) will be examined.

The research assistant concerned with manipulatory skills assembles evidence of the following: general outline of manipulatory activity, episodes in which the mother encourages the development of manipulatory skills, quality of mother-infant interaction in regard to the encouragement or discouragement of manipulatory skills, amount of time (and/or frequency) of mother-infant interaction relevant to infant manipulation, tabulation of types of toys available, and current status of infant's competence in manipulation. After measures have been derived on the basis of this evidence, they will be related both to the Griffiths' Eye-hand Coordination and Performance Scales and to the General Quotient.

The research assistant concerned with vocal (verbal) development assembles evidence of the following: mother's encouragement of imitation of verbalizations and vocalizations, teaching of verbalizations, mother-infant interaction stressing vocal (verbal) modes, contingency of maternal response to vocalization, considered both quantitatively and qualitatively, account of the baby's current level of vocal development. After measures have been derived on the basis of this evidence, they will be related to the Griffiths' Hearing and Speech Scale, and to the General Quotient.

In regard to each of the three analyses attention is given to the infants' interaction with the father and with any major substitute mother figure as well as to the mother.

Substantial progress has been made by the student assistants in this analysis of data, but it remains to be completed in 1974.

Objective 5. Influence of Quality of Attachment to Other Aspects of Development

1. Relationships to Other Persons

The only major analysis that has yet been undertaken is of behavior toward a stranger in the strange situation. This analysis was a detailed ethological type of behavioral analysis which yielded chiefly normative data, and will be reported therefore in another section.

2. Exploration and Sensorimotor Development

The relationship of attachment to exploratory behavior has been examined in two ways, both of which were mentioned earlier. First, the strange situation was originally devised for the express purpose of highlighting the phenomenon of a baby using his mother as a secure base from which to explore the world. It was demonstrated that the mother can and does indeed support exploration even in a strange situation and that her absence is generally associated with a marked decrement in exploration. This phenomenon was particularly conspicuous with securely attached infants (Group B). One group of insecurely attached infants (Group C) tended to explore less throughout the strange situation, even when the mother was present, than did the Group B infants. The other group of insecurely attached infants, those in whom defensive avoidant behavior was particularly conspicuous (Group A), maintained their exploratory behavior at a relatively high level even during the separation episodes. (Ainsworth & Wittig, 1969; Ainsworth & Bell, 1970; Ainsworth, Bell, & Stayton, 1971; Ainsworth, Blehar, and Wall, in preparation.)

Second, the relationship between infant-mother attachment and exploratory behavior at home was also studied. It was concluded (Ainsworth, Bell, & Stayton, 1971) that secure attachment relationships are associated with a smooth transition between exploratory and attachment behavior and that it was not so much the relative quantity of these behaviors that mattered as the quality of the attachment behaviors entering into the infant-mother attachment relationship. It also seems reasonable to suppose that there may be significant qualitative differences in exploratory behaviors between infants with different qualities of attachment relationship. This hypothesis cannot be tested until after the completion of the analysis of locomotor and manipulatory achievements mentioned in an earlier section.

The relationship of attachment to general sensorimotor development has been assessed indirectly through an examination of the relationship of different measures of maternal behavior to infant IQ in the fourth quarter, as measured by Griffiths' General Quotient. This analysis grew out of Stayton, Hogan, and Ainsworth's (1971) study of infant obedience, since IQ was included in the principal components analysis of variables relevant to obedience. It included a v riety of maternal variables--the only one available at the time the analysis was done--and certainly not selected for their apparent relevance to infant IQ. Four of these variables proved to be significantly correlated with infant IQ--sensitivity-insensitivity to infant signals ($r = .46$), acceptance-rejection ($r = .45$), cooperation-interference ($r = .44$), and amount of floor freedom permitted to the infant ($r = .46$).

A step-wise multiple regression analysis was undertaken with infant IQ as the criterion variable (Ainsworth & Bell, in press). Sensitivity-insensitivity to signals and floor freedom alone yielded a multiple correlation coefficient of .63 with infant IQ, although these variables themselves were orthogonal to each other (r = .07). Mothers who both were sensitive to signals and gave much floor freedom had the babies who were most accelerated in sensorimotor development, whereas mothers who both were insensitive to signals and gave little floor freedom had babies who were least accelerated. Addition of other maternal variables in the step-wise analysis raised the multiple correlation coefficient to .70. These and other studies relevant to the influence of maternal behavior on infant competence were discussed by Ainsworth and Bell (in press).

It is not expected that any combination of environmental variables will predict infant IQ at any higher level than .70--that is, account for more than approximately 50% of the variance. (Jensen to the contrary, however, our study combined with one by Beckwith (1971), who used adopted babies to control for genetic factors, suggests that environmental factors account for about 50% of the variance during at least the first year of life.) Nevertheless, the analysis reported by Ainsworth and Bell (in press) omits from consideration a variety of variables that might be hypothesized to correlate with infant IQ. Some of these are demographic variables such as level of parents' education and occupation. Some are environmental variables specifically "directed" toward encouraging development, namely, those upon which our analysis of locomotor, manipulatory, and vocal development focus upon (see page 51). Therefore, it is intended to undertake another step-wise multiple regression analysis, using not only the variables already identified as correlating significantly with IQ but also relevant demographic variables, variables stemming from the analysis of "encouragement" of sensorimotor development, and other maternal variables that have been devised since Stayton, Hogan, and Ainsworth (1971) reported their findings. It is expected that the demographic variables will not make a significant contribution toward "predicting" infant IQ in our middle-class sample. It is further expected that specific "encouragement" measures will be less significant components in the "prediction" than the measures already identified, namely, maternal sensitivity to infant signals, and degree of floor freedom permitted. Nevertheless, the relative weights of these several variables in the step-wise regression analysis should add significantly to our knowledge of the effect of environmental influences on infant sensorimotor development.

Three further studies have a bearing on the relationship between infant-mother attachment, exploration, and sensorimotor development. All three studies are dissertation researches of students under my supervision--students who were research assistants in this main project, and whose independent researches were based on and inspired by it.

The first of these was by Silvia Bell (1970) who hypothesized that the degree of harmony in mother-infant interaction (as reflected by the quality of infant-mother attachment assessed by strange-situation classification) would affect the development of the concept of the object. She devised two scales, one to measure the development of object permanence in accordance with the detailed observations of Piaget (1937), and another parallel scale to measure the development of the concept of permanence in regard to persons. She expected to confirm Piaget's (1937, 1954) assertion that the concept of person permanence tends to develop in advance of the concept of object permanence related to inanimate objects, but she also anticipated that such acceleration be found in subjects with relatively harmonious infant-mother relations (infants classified in Group B in terms of strange-situation behavior) and not in those whose relations were disharmonious (those classified as Group A or Group C).

Her findings confirmed her hypotheses in a clear-cut fashion. Infants with positive décalage (i.e. those in whom person-permanence was in advance of object-permanence) were in the majority--23 of 33 of her white middle-class subjects. All 23 were classified in Group B in the strange situation. Three subjects showed no décalage, one in each of Groups A, B, and C. Seven subjects showed a negative décalage, and these were all classified in either of Groups A or C, and none in Group B.

Furthermore, she found that by 13 months of age those babies who had been advanced all along in person permanence were significantly in advance of the others even in the development of the concept of permanence of inanimate objects. Thus, she demonstrated that the quality of the infant-mother attachment relationship has a significant effect on one important aspect of cognitive development.

The second study was by Mary Main (1973), who investigated the relationship between an infant's attachment to his mother at 12 months of age and exploration, play, and DQ at 21 months of age. She used both strange-situation classification (Groups B versus non-B) and resistant and avoidant behaviors in the strange situation as criteria of her independent variable (i.e. quality of the attachment relationship). When her 39 infants were 20½ months old they were given the Bayley Mental Development Scale, and when they were 21 months old they were introduced (with their mothers) to a 60-minute play session. This session consisted of two free-play sections, a section in which an adult playmate attempted to engage the child in interaction, and a final section (not yet analysed) in which the mother was instructed to play with the child.

In regard to the developmental testing session, three measures were obtained--the Bayley IQ, a measure of the degree of cooperation the child showed with the examiner, and a measure of his "game-like" spirit. The toddlers who at 12 months had been identified as securely attached (Group B) received a mean IQ of 111, whereas the insecurely attached group (non-B) received a mean of only 96--a difference significant at the .002 level. The B-group also were significantly more cooperative with the examiner and showed more game-like spirit, so the question arises whether they truly were advanced cognitively or whether they merely responded more fully in the test situation. (This is an important point both ways. On one hand it is probable that cooperativeness in the test situation colors all testing of young children--and indeed Birns and Golden (1972) have reported that cooperativeness is more predictive of later test scores than IQ itself. On the other hand it is clear that the IQ then does not assess any absolute level of cognitive function, but rather an elicited level--elicited by the examiner and by the test tasks.)

Dr. Main's attempt to answer these questions was to assess cognitive level from behavior that occurred spontaneously in the free-play sections of the play session. She examined several measures of language function and two measures of symbolic play. All of these measures favored the securely attached group, but only one of the language measures (number of morphemes emitted) significantly distinguished it from the insecurely attached group. (For her thesis, Dr. Main based some of these measures on only 10 minutes of free play; she intends to extend the analysis to 30 minutes in the hope of further testing her hypothesis.) Nevertheless, her findings are at least congruent with the hypothesis that children who had established a secure attachment to their mothers in the first year of life later become superior to others both in observed and in Bayley-tested level of cognitive function.

Dr. Main hypothesized further that securely attached infants would turn their attention more fully and more readily to exploration and play than would insecurely attached infants who were more concerned about their mothers' accessibility and responsiveness. Therefore they would not only explore and play more, but they would also learn more thereby (and hence should, as they did, score higher in IQ). Her expectations were fulfilled in regard to exploration of and behavior toward objects. Securely attached babies explored more intensely, in longer "bouts," and with more positive affect than did insecurely attached babies. They also paid more attention to the distinguishing features of objects--as shown by their response to a puzzle box.

A further hypothesis was that securely attached infants would be readier to enter into interactive play with an adult playmate than insecurely attached infants, on the assumption that good interaction with the mother would prepare these infants to be trustingly interactive with other well-intentioned adults. These expectations were clearly supported by the data. The securely attached group significantly more than the insecurely attached group approached the playmate, interacted with her, and significantly less frequently avoided her. They also tended to be more playful and laughed more during their interaction.

The insecure-attached group could be divided into two--Group A that was conspicuous for avoiding the mother in the reunion episodes of the strange-situation, and Group C that resisted her while at the same time seeking to gain and to maintain contact (i.e. they were ambivalent). Dr. Main hypothesized that Group A infants, more than Group C, would explore and learn through exploration, and hence would do relatively well in the Bayley test. This was because the avoidant behaviors that were their distinguishing characteristic could be interpreted as defensive (Ainsworth & Bell, 1970), and that so defended they could turn away from the anxiety-arousing mother toward inanimate objects. On the other hand, the ambivalent Group C infants could be expected to be preoccupied with mother's accessibility and responsiveness and hence less able to give themselves wholeheartedly to exploration and play. To test these hypotheses all the "dependent" variables were correlated with the measures of avoidance and resistance (directed to mother) in the strange situation.

The hypotheses were strongly supported by the data. Resistance was much more strongly and negatively correlated with IQ and with cooperation in the test situation than was avoidance. Resistance was also negatively correlated with intensity of exploration and with bout length, whereas the comparable correlations for avoidance did not reach significance. On the other hand, avoidance more than resistance was negatively correlated with game-like spirit in the test situation, and with positive affect in exploration, and positively correlated with apparently non-aggressive hitting and banging in play. Furthermore, avoidance of the mother in the strange situation was significantly and postively correlated with avoidance of the adult playmate in the later play session.

This brief and incomplete summary of Dr. Main's research offers strong support to the hypothesis implicit in our Aim 5, namely, that the quality of the attachment relationship that a baby establishes with his mother influences exploration, play, and cognitive development. The findings are all the more telling in that a nine-month gap separated the assessment of attachment and the assessments of exploration, play, and cognitive function.

The third dissertation relevant to Aim 5 is by Thomas Pentz. This study has not yet yielded findings, although data collection is nearly complete. Pentz's concern is with language development. His hypotheses are: (1) mothers present to their children a "corpus" of language that is more or less tailored to the child's level of development, (2) mothers sensitive to the child's signals and communications will tailor their "corpus" more adeptly to the child's level than will those less sensitive, and (3) children whose mothers are more sensitive (and who are therefore more securely attached) will be more influenced by mother's language and hence more advanced in language development than children whose mothers are less sensitive (and who are therefore more insecurely attached).

Pentz has introduced 30 children at 28 months to our "strange situation", in order to identify those who are securely attached (Group B) and who may thus be inferred to have more sensitive mothers (Ainsworth, Bell, & Stayton, 1971), from those who are insecurely attached (Groups A and C). At about the same age, he introduced the children and their mothers into a free-play session in the laboratory in the course of which a number of specific measures of both infant and maternal language were obtained. At the age of 36 months the mother-child pair is observed in a second free-play session, and about the same time the child's comprehension of language is assessed by a special test. The design not only enables Pentz to assess the influence of quality of child-mother attachment (Group B versus non-B) on language development, but further, through a comparison of maternal language in the first versus the second free-play session, enables him to assess the extent to which maternal language shifts in response to the developmental level of the child. The child's language accomplishments may be compared from 28 to 36 months, and his comprehension assessed at 36 months. This study, undertaken with sophisticated psycholinguistic measures, promises to be a fine supplement to Dr. Main's research in the determination of the extent to which the quality of infant-mother attachment influences subsequent cognitive development.

Finally, there are a few miscellaneous findings of relations between IQ and attachment. Contact-maintaining in the reunion episodes of the strange situation was found, for 23 babies of our main sample, to be significantly related to Griffiths' General Quotient in the fourth quarter (r = .41). This finding is of interest because it has been suggested by some that the absence of contact- and proximity-seeking behavior in the strange situation may indicate a relatively mature response (Maccoby, 1971) or relatively advanced cognitive development (Spelke et al., 1973). Our finding suggests, on the contrary, that contact-maintaining behavior in the strange situation (at least for one-year-olds) is neither immature nor indicative of lagging cognitive development. The correlation can be accounted for by the fact that both contact-maintaining in the reunion episodes of the strange situation and IQ are positively and significantly related to variables such as maternal sensitivity to infant signals and communications.

Another infant behavior significantly related to Griffiths' IQ is search behavior in the separation episodes of the strange situation (r = .45). One obvious explanation of this finding is that high scores on search behavior depend on efficient locomotion, and this in turn is related to relatively high IQ. Other infant behaviors related to IQ, but short of statistical significance are: positive response to being put down (r = .30), which is often an occasion for a baby to move off into independent exploratory activity, and following when mother leaves the room (r = .33), which also involves locomotion.

The Strange Situation

Repeated references have been made to the strange situation in the course of this report. Although originally designed as a mere supplement to the naturalistic longitudinal observations of the development of infant-mother attachment, it has proven to be a very useful basis for the assessment of the "end-point" of this development, at least in the first year of life. It provides a method for identifying qualitative differences in the ways in which attachment behavior has become organized in different infants.

Strange-situation findings have already been published in three papers. The first by Ainsworth and Wittig (presented at a conference in 1965 and published with the conference proceedings in 1969) was a preliminary report based on the first 14 subjects. The second by Ainsworth and Bell (1970) consisted of a normative account of the behavior of 56 subjects in the context of a theoretical discussion. The third by Ainsworth, Bell, and Stayton (1971) dealt with individual differences in strange-situation behavior of these 56 subjects, and presented a revision of the classificatory system first proposed by Ainsworth and Wittig (1969). For the 23 subjects who had also been observed longitudinally comparisons were made between strange-situation classification and behavior at home, and also with maternal behavior observed in the home environment.

By 1972-3 four distinct samples of white, middle-class, one-year-olds had been observed in the strange situation, yielding a total sample of 106 infants. During that year top priority was given to analysis of these data and to the preparation of two further publications. One of these deals specifically with the responses of one-year-olds to a stranger in the strange situation (Bretherton and Ainsworth, in press). The other is a monograph by Ainsworth, Blehar, and Wall which is intended to provide a comprehensive account of all the strange-situation findings. The first draft of the monograph is very nearly completed. Its completion will be my first task after having finished this application for further financial support.

Strange-situation monograph. It is not feasible to attempt to cover in this report all of the findings to be included in the strange-situation monograph. Some of these findings have already been mentioned where relevant to other sections of this report. I shall give no further detail, but I can at least give a general outline of what the monograph will cover.

Let me first say a few words about the significance of our strange-situation research, covering points that will be included in the introduction to the monograph. We can perceive two main values to a comprehensive report of this research. First, we have devised a method for studying attachment behavior in a controlled laboratory situation. (This was seminal research, because many others have taken their cue from us, and, with or without variations in procedure, have conducted laboratory studies of attachment behavior.) Second, our strange-situation procedure, unlike the procedures devised by others, provides a method of assessment of infant-mother attachment that can be used to good effect either as a "dependent variable" in studies of the effect of environmental variables on infant-mother attachment, or as an "independent variable" in studies of the relation of infant-mother attachment to other facets of development.

As a laboratory method for studying attachment behavior, the strange-situation procedure has many advantages. It was designed from the outset on the premise that attachment behavior is variable from one situation to another, and most readily elicited under conditions of stress. (We used mild stress, equivalent to stresses an infant is likely to encounter with fair frequency in everyday life--such as encounter with a stranger and very brief separations whilst in an unfamiliar situation.) It was designed also in accordance with our theoretical proposition that attachment behavior must be viewed as but one class of behavioral system that interacts with other systems. Thus the episodes of the strange situation were deliberately designed to induce conflict between systems, and indeed to tip the resolution of the conflict first in one direction and then in another. Thus the first major episode of the situation (Episode 2) induced a conflict between exploratory behavior elicited by an attractive array of toys in an unfamiliar but not threatening environment and attachment behavior directed toward the mother, with the hypothesis that most one-year-olds would have exploratory behavior more strongly activated than attachment behavior. Episode 3 was designed to complicate the conflict situation by the entrance of the stranger. Exploratory behavior was expected to be still activated by the toys, but it seemed likely that a strange person might activate both fear (or wary) behavior (which would interact with attachment behavior) and either exploratory or affiliative behavior directed toward the stranger. The baby thus would be conflicted about whether to continue playing with the toys, whether to approach the stranger, or whether to avoid the stranger and move toward the mother. Subsequently, two separations were expected to tip the balance from exploratory (and/or affiliative behavior) to attachment behavior, the second separation more strongly than the first. Two reunion episodes were also expected to highlight attachment behavior, the second more strongly than the first. This sequence of episodes enables one to test theoretical expectations against observed behavior. It also overrides the apparent "instability" of attachment behavior--i.e. the fact that an infant who is clearly attached to his mother may under nonstressful circumstances show attachment behavior only intermittently.

Although others have studied the attachment behavior of infants and young children in a laboratory situation (e.g. Coates, Anderson, and Hartup, 1972a, 1972b; Messer, & Lewis, 1972; Maccoby and Feldman, 1972) and some have specifically addressed themselves to the role of the mother's presence in supporting exploratory behavior (e.g. Cox and Campbell, 1968; Rheingold, 1969), the comprehensive account of our findings that the monograph will provide is considered very important for three reasons. First, one sample of infants was observed both in the strange situation and also intensively at home. This gives a context within which their strange-situation behavior may be viewed, and also answers some questions about stability of attachment behavior across situations that has been raised by some of these other studies. Second, not only do we have a larger total sample observed in a standard laboratory situation than that of any other study, but we can identify four separate component subsamples and test the replicability of behavior from one sample to another. (So few significant differences between subsamples were found--fewer than might be predicted by chance--that we may conclude that strange-situation behavior is highly replicable in our age group.) Third, ours can be distinguished from other studies in terms of explicit hypotheses, rooted in the theoretical background that has guided our entire research project, which makes it possible to interpret our findings on other than a *post hoc* basis.

Furthermore, if our strange-situation procedure is to be used as a method of assessment of infant-mother attachment, then full publication of our procedures is essential so that they can be replicated by others, and full publication of our findings is required as at least initial validation of the method of assessment. A large section of the monograph is procedural. The findings are reported in five main sections, as follows.

Normative trends. The following behavioral measures were examined and found significantly to change across episodes, both in accordance with hypotheses and in replication of normative trands previously reported by Ainsworth and Bell (1970): exploratory locomotion, exploratory manipulation, visual exploration, crying, search behavior (in separation episodes), seeking proximity and contact, maintaining contact, distance interaction, avoiding proximity and interaction, and resisting contact and interaction. (The latter five measures were examined separately for the mother and for the stranger.) Several alternative measures were examined, in order to make possible comparisons with other studies which had not used the same measures that we did. In addition certain discrete behaviors were examined across episodes: smiling, vocalization, looking, and "oral" behavior. The normative findings will not be reported here; to do so would necessitate reproducing this part of the draft monograph *in toto*. (The findings were similar to those obtained by Ainsworth and Bell, 1970.)

A description of behavior in each episode. The chief purposes of this descriptive treatment were (a) to see how the behavioral trends, previously reported separately, interlock with each other, and (b) to indicate the nature and scope of individual differences. In this descriptive treatment we move away from citing means of each behavioral measure for each episode toward citing percentages of the total sample showing each behavior and combination of behaviors. Furthermore, the behaviors reported in this section are specific and discrete for the most part, whereas for the purposes of normative trends a number of them (specifically those pertaining to an infant's interaction with other people) were combined together because they had the same "predictable outcome." Thus, for example, the measure of proximity- and contact-seeking behavior included various behaviors differing in strength and/or degree of initiative, such as directed cries, reaching, partial approaches, full approaches, and clambering up. In our descriptive account these behaviors were dealt with separately. As in the case of normative trends, the descriptions of behavior in each episode will not be reported here. (An example of the use of this descriptive analysis is provided by Bretherton and Ainsworth, in press--a copy of which will accompany this report.)

Individual differences in strange situation behavior. This section of the draft monograph begins by considering the distribution of cases among the three classificatory groups (A, B, and C) as well as the seven subgroups that have been distinguished. Two kinds of checks of the criteria for classification are examined. The first details the differences between the subgroups of the interactive behavioral measures (toward the mother) that formed the basis of the classification, and also of similar measures of behavior to the stranger, and measures of the frequency of crying and exploratory behavior. These findings confirm the previously published findings of the first two subsamples as reported by Ainsworth, Bell, and Stayton (1971) and will not be duplicated here. A second more formal test of the objectivity and replicability of our classifications was provided by discriminant analyses and also by the work of Connell and Rosenberg discussed earlier in this report (see pp. 27-28, 31). Furthermore, the factor analysis to which reference was made on pp. 28-29 will be presented in this section of the monograph.

A final topic to be included in this third section of findings deals with the effect of repetition of the strange situation. We introduced a sample of 23 infants (Sample 3) twice to the strange situation, at 50 weeks and again at 52 weeks of age. Although it was expected that the first experience in the situation would affect behavior in the second session, it was also expected that the major behaviors in interaction with the mother would remain stable in a rank-order, correlative sense. These expectations were partially fulfilled, as may be seen in Table 13.

Table 13

Correlations and Comparison of Means between Sessions 1 and 2 in the Strange Situation

Variable	Episodes	Session 1 Mean	Session 2 Mean	Signif. of Dif.	r
Contact maintaining (M)	2 & 3	4.15	5.33	ns	.05
Contact maintaining (M)	5 & 8	7.06	8.29	$<.05$	$.56^{**}$
Proximity seeking (M)	2 & 3	4.75	6.06	$<.05$	$.56^{**}$
Proximity seeking (M)	5 & 8	7.00	8.13	$<.01$	.17
Resist (M)	5 & 8	3.37	3.58	ns	.04
Avoid (M)	5 & 8	5.60	3.71	$<.01$	$.66^{**}$
Search	4, 6 & 7	8.81	10.96	$<.01$	$.47^{*}$
Crying	4, 6 & 7	14.01	22.05	$<.01$	$.62^{**}$
Crying	All eps.	19.52	30.44	$<.01$	$.74^{**}$
Contact maintaining (S)	4 & 7	3.69	3.87	ns	.26
Proximity seeking (S)	4 & 7	3.77	3.75	ns	.31
Resist (S)	4 & 7	3.71	4.85	$<.05$	$.42^{*}$
Avoid (S)	4 & 7	3.96	4.27	ns	.24

$^{*}p < .05$; $^{**}p < .01$

There is gratifying evidence of stability in regard to interaction with the mother; significant positive correlations were found for contact-maintaining and proximity-avoiding behavior in the reunion episodes, and for proximity seeking to mother in the preseparation episodes. Furthermore, crying, search behavior in the separation episodes and resistant behavior to the stranger also emerged as relatively stable. The only correlational finding that did not fit the hypothesis of stability pertained to proximity seeking in the reunion episodes. If we can view the strange-situation procedure as constituting a situational test--and I think we can--we can be astonished at the degree of test-retest stability that emerged, for situational tests are notoriously unstable according to a test-retest criterion.

The most interesting set of findings in the test-retest study, however, is the extent to which infants' behavior in the second session was affected by their experience in the first. Table 13 shows that in the second session babies significantly more frequently sought proximity with their mothers in both preseparation and reunion episodes, sought to maintain contact with their mothers in the reunion episodes, searched for her in the separation episodes, and cried both in the separation episodes and in the situation as a whole. Thus both attachment behavior and distress were significantly heightened in the second session. (This was so in the case of 21 of 23 infants, and is not merely a reflection of mean differences.) Babies did not become more resistant to their mothers in the second session, and indeed became less avoidant. This ambivalence did not increase and avoidant defenses tended to be lowered--although infants who avoided their mothers in the first session still did so in the second session, but less strikingly.

Ainsworth (1973) pointed out that these findings have profound significance for the etiology of anxious attachment. Stayton and Ainsworth (1973) already presented evidence that anxious attachment is related to maternal inaccessibility and unresponsiveness at home. Here we have evidence that a repetition of separation experience in an unfamiliar environment increases separation anxiety. If two very brief separations in one session, not exceeding 9 minutes in all, can have so much effect on behavior in a second session two weeks later, it is reasonable to suppose that longer and more frequent experiences can have an even greater effect. This finding was of course relevant to the findings of Blehar (in press), which were discussed earlier, on the effect of full-time day care on young children.

The relation of home behavior to strange situation behavior constitutes a fourth section of results in the monograph, and the relation of maternal behavior to infant strange-situation behavior a fifth. Finally, the monograph will refer to separately published studies by Bell (1970), Blehar (in press), and Main (1973). Since all of these findings have been discussed in other sections of this report, they will not be discussed further here. (See pp. 32-34, 46-47, 49-51, 53-55).

Paper on responses to a stranger in a strange situation. A preliminary version of this paper was presented at the annual meeting of the Eastern Psychological Association in Boston in April 1972, in a symposium on fear of strangers. That version was prepared for publication, but upon the advice of critics further and more detailed data analysis was completed. An expanded version of the paper was prepared for presentation to a small conference on infant fear held in October 1973 at E.T.S. in Princeton. This version will be published as part of the conference proceedings.

The analysis upon which this paper was based focused on Episode 3 in which both the stranger and the mother are present, and prior to the disruption of the separation episodes. Episode 3 consists of three parts, each of a minute's duration, which were analyzed separately: (a) the stranger enters and then is non-participant, sitting quietly in her chair, (b) the stranger engages the mother in conversation, (c) the stranger approaches the baby and attempts to engage him in play through the intermediary of a toy. Furthermore, special note was made of the baby's initial response to the stranger's entrance in (a) and to her approach in (c). New coding was undertaken of the narrative records in order to support a detailed descriptive analysis of behavior. Results were analyzed separately for each of the four component subsamples. Since an insignificant number of statistically significant differences were found between the subsamples, the total sample of 106 infants was treated as a whole.

The findings are essentially descriptive, detailing the numbers of infants who show each of the specified behaviors or combinations of behaviors at each of five points in Episode #3 that were subject to analysis, or in the episode as a whole. The main thrust of the paper was theoretical, although each major point was well supported by the descriptive data. Here I shall summarize the theoretical discussion, and only indirectly refer to the findings.

The discussion suggested that the findings could be understood in the light of an hypothesized interplay among four major behavioral systems that were activated in the strange situation. Two of these--the fear-wariness system and the attachment system--are closely linked in that both tend to be activated by an alarming stimulus. The fear-wariness system includes escape from or avoidance of the alarming stimulus (which often also imply approach to the attachment figure), distress behavior (which serves also to signal the attachment figure to approach), and behaviors that maintain distance from the alarming stimulus. Whereas locomotor avoidance and overt distress were infrequent, wary, distance-maintaining behaviors occurred in the great majority of infants. These behaviors included gaze aversion, reluctance to accept the toy the stranger offered, and a variety of behaviors such as intention movements, partial approaches, coy behavior, and tentative movements toward the stranger's toy that suggested a conflict between wariness and an affiliative response to the stranger. We also suggested that the prolonged visual inspection (with inhibition of movement) with which many infants greeted the stranger's entrance might also be considered to reflect the activation of the fear-wariness system. Locomotor retreat from the stranger to the mother did not appear to be a dependable indication of strong activation of fear, since nearly all of those few infants bold enough to approach the stranger also retreated to the mother, without any indication of actual distress.

The exploratory system that was strongly activated by the toys before the stranger appeared seemed to be overridden by other systems in Episode #3. Exploration of the toys declined abruptly. The stranger herself did not seem to activate exploratory behavior, for very few infants approached her spontaneously and almost none touched her--in striking contrast to the behavior toward the toys in the previous episode. If there was exploration of the stranger it was almost entirely visual--a cautious exploration while maintaining distance, or, in other words, exploration in the service of wariness.

The attachment system was activated in nearly half of the infants, expressing itself in some through distress signals, but in most through active approach to the mother. Proximity seeking was clearly activated by alarm rather than by a desire to interact with the mother, for most infants having acchieved proximity turned to face the stranger. It was as though the fear-wariness system was reduced in intensity of activation through proximity to the attachment figure, and the baby could then continue the wary exploration implicit in looking at the stranger. (Certainly infants looked at the stranger very significantly more than they looked at the mother, a fact that casts doubt on the usefulness of classifying looking as an attachment behavior.)

In nearly all of the infants there was evidence that the stranger activated some degree of affiliative response. A majority smiled at her at least once (and at least as many smiles were directed to the stranger as to the mother). We suggested, however, that at least some of the smiles to the stranger were propitiatory, reflecting the fear-wariness system, rather than invitations to closer interaction. Coy smiling, combined with gaze aversion, particularly seemed to be the resultant of conflicting and wary tendencies. When the stranger invited them to play, more than half of the babies were able to respond in some positive degree to her overtures. But here also frequent conflict between affiliative and wary behaviors was shown in intention movements, and other tentative responses that fell short of straightforward acceptance of the stranger's toy.

The strange situation had been designed to facilitate both conflict and interplay among these four behavioral systems, and the analysis of Episode #3 clearly demonstrated that it did so. The paper ended with a more detailed discussion of ways in which interplay between systems was manifested.

Publications

This project has already yielded 18 publications, including 5 that are still in press. In addition, 3 papers have been presented at recent meetings that have not yet been prepared for publication. Furthermore, there have been three relevant Ph.D. dissertations completed, one published, one accepted for publication, and one still being prepared for publication. In the list of references which follows these items have been marked *.

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